JOURNAL OF RESEARCH of the National Bureau of Standards—A. Physics and Chemistry
Vol. 74A, No. 2, March–April 1970

A Theoretical Investigation of the Configurations $(3d+4s)^5\,4p$ in Neutral Chromium (Cr I)

C. Roth*

(October 13, 1969)

Experimental levels of the configurations $(3d+4s)^5 4p$ in Cr I were compared with corresponding calculated values. On fitting 296 experimental levels by means of 20 free parameters a rms error of 183 cm^{-1} was obtained. All the 684 theoretically predicted levels and g-factors are calculated.

It is shown that the correction parameters β and T are not significant here.

Key words: Chromium; configurations in Cr I; configurations $(3d+4s)^5 4p$ in Cr I; configuration interaction; Cr I; energy levels of Cr I; first spectrum; g-values Cr I; parameters; theory; Zeeman effect.

1. Introduction

Theoretical investigations of odd configurations for trebly and doubly ionized atoms of the iron group were performed by the author [1–4][1,2]. The configurations $(3d+4s)^n 4p$ were considered previously for the arc spectra of calcium, scandium, titanium, and vanadium [5–7].

The configurations $(d+s)^5 p$ comprise 272 terms splitting into 684 levels. In AEL [8], 94 terms splitting into 310 levels are assigned to the configurations $3d^5 4p + 3d^4 4s 4p$. In addition 2 terms splitting into 6 levels have no configuration designation and 3 further odd levels are given with no term designations.

The initial parameters were obtained after examining the final values of Ca I, Sc I, Ti I, and V I [6–7]. By using least squares optimization the best straight lines were obtained for all the parameters[3] and then the values of Cr I were extrapolated. Then, initially

$$\begin{aligned} B &= 610 \\ B' &= 800 \\ C &= 2700 \\ C' &= 2860 \\ G'_{ds} &= 1430 \\ F_2 &= 170 \\ F'_2 &= 280 \\ G'_{ps} &= 6200 \\ G_1 &= 230 \\ G'_1 &= 250 \\ G_3 = G'_3 &= 17 \\ \alpha = \alpha' &= 65 \\ H &= 125 \\ J &= 1000 \\ K &= 2500 \\ \zeta = \zeta'_d &= 200 \\ \zeta_p = \zeta'_p &= 170. \end{aligned} \tag{1}$$

For J and K the final values of V I were taken, since these parameters did not behave regularly from Ca I to V I. For H only the values of Ti I and V I were considered.

The initial value for the height of the configuration d^4sp was obtained by considering the electrostatic matrices of ^{7}F, ^{7}D, and ^{5}I, [9], all of order 1.

Now,

$$A' - 21B' - 4G'_{ds} - 2F'_2 - G'_{ps} - 10G'_1 - 20G'_3 + 6\alpha' = {}^7\mathrm{F}_{\mathrm{C.G.}} = 25{,}430$$

$$A' - 21B' - 4G'_{ds} + 7F'_2 - G'_{ps} - 10G'_1 - 35G'_3 + 6\alpha' = {}^7\mathrm{D}_{\mathrm{C.G.}} = 27{,}611$$

$$A' - 17B' + 4C' - 3G'_{ds} + F'_2 - G'_{ps} - 10G'_1 - 10G'_3 + 30\alpha' = {}^5\mathrm{I}_{\mathrm{C.G.}} = 44{,}458.$$

*An invited paper. Present address: McGill University, Montreal, Canada.

[1] Figures in brackets indicate literature references at the end of this paper.

[2] The reader is referred to these papers for an explanation of the method used, notation and significance of the various parameters. The numerical values of all levels and parameters are in cm^{-1}

[3] Unprimed parameters refer to the configuration $3d^5 4p$, primed parameters to $3d^4 4s 4p$ and doubly primed parameters to $3d^3 4s^2 4p$.

By using the values of the parameters in (1) we obtain for the average value of A'

$$A' = 57260. \tag{2}$$

The height of d^5p is then obtained by using the electrostatic matrix of ^{7}P and the fact that its trace should equal the sum of the eigenvalues of $z^7P_{C.G.}$ at 23,415 and $y^7P_{C.G.}$ at 27,848.
Since,

$$\begin{array}{ll} (^6S)^7P & \left[\begin{array}{cc} A-35B-10G_1-35G_3 & \sqrt{2}(K-J) \\ \sqrt{2}(K-J) & A'-21B'-7F_2'-4G_{ds}'-G_{ps}' \\ & -35G_3'+6\alpha' \end{array}\right] \\ {}^5D(^3P)^7P & \end{array}$$

from (1) and (2) we obtain

$$A = 49130. \tag{3}$$

The parameters β and T improved the results for the configurations $3d^n4p$ in the third spectra by 25 percent and in the second spectra by 21 percent [1, 2]. Hence it was natural to consider the effects of these parameters in the first spectra, as well. For Ti I and V I, β and T were not significant.

In the diagonalization of the second iteration the parameter β, β', T, and T' were inserted with values of zero, and then in the least squares with these parameters eliminated the rms error was reduced to 285 with

$$\beta = \beta' = -840 \pm 14. \tag{4}$$

However, the parameter T was not significant as, furthermore, with $T = T'$ we had

$$\begin{aligned} \beta &= \beta' = -829 \pm 18 \\ T &= T' = -0.5 \pm 0.6 \\ &\text{rms error} = 285. \end{aligned} \tag{5}$$

Partly, this result is as anticipated, since as Racah has shown [11], for d^5 it is only necessary to consider β, and furthermore, since T is not important in d^4p (V I) we would expect a similar result for d^4sp (Cr I). However, it is disturbing that β should only be relevant for Cr I and not for the first spectra of the lighter atoms.

Since in V I [7], the results were greatly improved by considering the configuration $3d^24s^24p$ and its interactions with $3d^34s4p$ and $3d^44p$, a similar investigation was attempted for Cr I.

By using the final values of the parameters for V I and equations (8) and (9) of [7] we obtain for the difference between the weighted averages of the terms of these configurations

$$D''(\mathrm{V}) = M''(3d^24s^24p) - M'(3d^34s4p) = 17{,}410. \tag{6}$$

Then from equations (11), (14) of [7] and (6) we obtain

$$D''(\mathrm{Cr}) = M''(3d^34s^24p) - M'(3d^44s4p) = 22{,}650. \tag{7}$$

The parameters with their standard errors obtained in the least squares optimization of the second iteration for the configurations $3d^54p + 3d^44s4p$ with β and β' eliminated, are given in table 1.

TABLE 1. *Final parameters for* Cr I—$(3d+4s)^5$4p

Parameter	$3d^54p + 3d^44s4p$	$3d^54p + 3d^44s4p + 3d^34s^24p$
A	50,207 ± 231	51,030 ± 228
A'	56,128 ± 286	56,738 ± 271
A''	.....	73,448 ± 502
B	670 ± 8	677 ± 7
B'	802 ± 5	755 ± 5
B''	.....	833 (Arith. Progress.)
C	2,592 ± 15	2,445 ± 15
C'	2,731 ± 12	2,918 ± 12
C''	.....	3,391 (Arith. Progress.)
G_{ds}'	1,583 ± 18	1,590 ± 19
$G = G_{ds}'$	.....	1,590
F_2	201 ± 10	187 ± 10
F_2'	268 ± 5	275 ± 5
F_2''	.....	363 (Arith. Progress.)
G_{ps}'	6,091 ± 49	6,155 ± 45
G_1	223 ± 7	224 ± 7
G_1'	237 ± 5	236 ± 5
G_1''	.....	248 (Arith. Progress.)
G_3	15 ± 1	16 ± 1
G_3'	15 (Equal)	16 (Equal)
$G_3'' = G_3'$	.....	16
α	60 ± 1	63 ± 1
α'	60 (Equal)	63 (Equal)
$\alpha'' = \alpha'$	.....	63
H	162 ± 6	157 ± 4
$H' = H$	.....	157
J	879 ± 38	954 ± 32
$J' = J$	.....	954
K	2,160 ± 35	2,311 ± 30
K'	.....	3,011 (Fixed Diff.)
$\zeta_d = \zeta_d'$	280 ± 26	247 ± 24
$\zeta_d'' = \zeta_d'$	.....	247
$\zeta_p = \zeta_p'$	142 ± 59	184 ± 51
$\zeta_p'' = \zeta_p'$	.....	184
rms error	359	183.1

By assuming that the parameters B, C, and G_1 are in arithmetic progression for the three configurations, i.e.,

$$\begin{aligned} B'' &= 934 \\ C'' &= 2870 \\ G_1'' &= 251 \end{aligned}$$

and using eqs (8) and (9) of [7] we obtain

$$\begin{aligned} M'(3d^44s4p) &= 54{,}977 \\ M''(3d^34s^24p) &= A'' + 2269. \end{aligned} \tag{8}$$

Then from eqs (6) and (8)

$$A'' = 75{,}358. \tag{9}$$

2. Results and Discussion

As for V I, when the configurations $(3d+4s)^5 4p$ were considered rather than $3d^5 4p + 3d^4 4s 4p$ the results improved greatly. Interestingly, the effect of β was of a very different magnitude than for the case of two configurations. In the final results the rms error was 181 with

$$\beta = \beta' = \beta'' = -184 \pm 92. \qquad (10)$$

When, in addition the parameter T was left to vary the rms error *rose* to 182 with

$$T = T' = T'' = -0.56 \pm 0.61. \qquad (11)$$

When both β and T were eliminated the rms error was only 183. Thus it is evident that in the case of two configurations the considerable reduction in the rms error when β was left to vary freely is due to the fact that this parameter absorbed some of the effects of the interactions with the configuration $3d^3 4s^2 4p$. Thus the previous value of -840 for β is not significant.

In the least squares calculation of the final iteration of the "uniform treatment" (see ref. [6], β and T eliminated) 85 experimental terms splitting into 296 levels were inserted to yield an rms error of only 183. The comparison of the experimental and calculated values of the levels and g-factors obtained from the final least squares calculations of the uniform treatment is given in table 2. As for V I, A'' was allowed to vary freely, and thus the calculated values, percentage compositions and g-factors for all the 684 theoretically predicted levels are given in table 2. The final values of the parameters are given in table 1.

The main reasons for fixing $\zeta_d = \zeta_d'$ and $\zeta_p = \zeta_p'$. are that the fitted values of the parameters are reasonable, and only small differences occur between ζ_d and ζ_d' as well as ζ_p and ζ_p', but *very* large standard errors are associated with them. Furthermore, as the results are from a uniform treatment, consideration was also given to the results of keeping ζ_p' and ζ_d' free in Sc I, Ti I and V I, [6], [7]. There the above effects are even more pronounced.

Since G'_{ps} is much larger than G'_{ds}, the $p-s$ interaction is stronger than the $d-s$ interaction. Consequently the terms of d^4sp are coupled as $d^4(v_1 S_1 L_1) sp\,(^{1,3}\mathrm{P})SL$ and not $d^4s(S_2 L_1)pSL$ as given in AEL, [8].

The four high experimental terms r^3H, q^3H, p^3H and p^3G, all above 62,000 cm^{-1} were not included in the least-squares calculation as it was doubtful to which theoretical terms they should be assigned (see table 2).

Below 62,000 cm^{-1} the following 28 levels were excluded:

1. The three levels of $3d^4 4s(a^4\mathrm{D})4px\,^5\mathrm{P}$
2. The three levels of $3d^5(a^4\mathrm{P})4pw\,^5\mathrm{P}$
3. The five levels of $3d^5(b^4\mathrm{D})4pv\,^5\mathrm{F}$
4. The level $3d^4 4s(c^4\mathrm{D})4pt\,^5\mathrm{F}_4$
5. The three levels of $3d^4 4s(a^4\mathrm{F})4px\,^3\mathrm{G}$
6. The three levels of $3d^5(a^2\mathrm{I})4pv\,^3\mathrm{H}$
7. The three levels of $3d^5(a^2\mathrm{F})4pu\,^3\mathrm{F}$
8. The three levels of $3d^5(a^2\mathrm{F})4pt\,^3\mathrm{D}$
9. The three levels of $3d^5(b^4\mathrm{F})4pq\,^3\mathrm{F}$
10. The level 3° at 61,676.

From the initial diagonalization it is evident that one of the four experimental terms x^5P, w^5P, v^5P, and t^5P in the range 40,000 to 50,000 can not be assigned to $3d^5 4p + 3d^4 4s 4p$, as in the wider range 30,000 to 54,000 only three terms ^{5}P are theoretically predicted. We note, however, that since $3d^5(a^6\mathrm{S})4pz\,^7\mathrm{P}_{\mathrm{C.G.}}$ is at 23,400, $3d^5(a^6\mathrm{S})5px\,^7\mathrm{P}_{\mathrm{C.G.}}$ is at 42,260 and $3d^5(a^6\mathrm{S})4pz\,^5\mathrm{P}_{\mathrm{C.G.}}$ is at 26,800 we would expect that the lowest term ^{5}P of $(3d+4s)^5 5p$, i.e., $3d^5(a^6\mathrm{S})5p\,^5\mathrm{P}$ should be at around the height of the experimental term w^5P. More specifically, by considering diagonal elements we have

$$(^6\mathrm{S})^7\mathrm{P} : A - 35B - 10G_1 - 35G_3$$

$$(^6\mathrm{S})^5\mathrm{P} : A - 35B + 2G_1 + 7G_3.$$

Thus, $(^6\mathrm{S})^5$P is higher than $(^6\mathrm{S})^7$P by approximately $12G_1 + 42G_3$, which from table 1 equals 3360, almost exactly the difference between $z^5\mathrm{P}_{\mathrm{C.G.}}$ and $z^7\mathrm{P}_{\mathrm{C.G.}}$. By making the approximation that the values of the parameters pertaining to configurations containing a $5p$ electron are about half of the corresponding values for configurations with a $4p$ electron[4] we calculate $3d^5(a^6\mathrm{S})5p\,^5\mathrm{P}_{\mathrm{C.G.}}$ to be at 44,000. Thus, the experimental term w^5P should be assigned as $3d^5(a^6\mathrm{S})5pw\,^5\mathrm{P}$.

The calculated value for the term $^5\mathrm{D}(^1\mathrm{P})x\,^5\mathrm{P}_{\mathrm{C.G.}}$ is at 42,500 and thus higher by 1,500 than the experimental value for $x^5\mathrm{P}_{\mathrm{C.G.}}$. However, this very large difference can be attributed to the fact that the interaction with $3d^5(a^6\mathrm{S})5pw\,^5\mathrm{P}$ is very strong, since the difference between the heights of the unperturbed terms x^5P and w^5P is very small. As this interaction was not considered explicitly, the term x^5P was not included in the least-squares calculations. It is interesting to note that the levels of x^5P are based on combinations with levels of eleven even terms, whereas w^5P is based on combinations with levels of only four even terms, [10].

In the range 45,200 to 48,200 there are five experimental ^{5}F terms assigned to $(3d+4s)^5 4p$. However, in the wider range 41,500 to 50,000, only three theoretical ^{5}F terms are predicted. The experimental terms x^5F and w^5F fit the two theoretical terms $\mathrm{A}^3\mathrm{F}(^3\mathrm{P})^5\mathrm{F}$ and $^3\mathrm{G}(^3\mathrm{P})^5\mathrm{F} + (^4\mathrm{D})^5\mathrm{F}$, respectively. To the theoretical term $(^4\mathrm{G})^5\mathrm{F} + \mathrm{A}^3\mathrm{F}(^3\mathrm{P})^5\mathrm{F}$, we can assign either v^5F, u^5F or t^5F.

As for the case of w^5P we note that since $z^5\mathrm{F}_{\mathrm{C.G.}}$ is near 31,000, one of the experimental terms v^5F, u^5F, t^5F or s^5F should be assigned $3d^4\,^5\mathrm{D}(4s5p\,^3\mathrm{P})^5\mathrm{F}$. Since in this spectrum there are many more experimental terms than electrostatic parameters, initially the two theoretical terms $(^4\mathrm{G})^5\mathrm{F} + \mathrm{A}^3\mathrm{F}(^3\mathrm{P})^5\mathrm{F}$ at around 48,000 and $(^4\mathrm{D})^5$F at around 50,000 were left vacant (none of the experimental terms v^5F, u^5F, t^5F or s^5F was inserted).

[4] This assumption is quite reasonable especially in view of the results for Ni I, where we also considered the configurations $3d^9 4p + 3d^8 4s 4p + 3d^9 5p$ as well as the configuration $3d^9 5p$ alone. Results to be published soon.

Since in the last iteration the calculated values of the levels of $(^4D)^5F$ corresponded very closely to the experimental levels of $3d^4 4s(a\,^6D)5ps\,^5F$ (mean deviation of -49), we assigned the experimental term $s\,^5F$ to $(^4D)^5F$. It should be noted that the difference between $s\,^5F_{C.G.}$ and $z\,^5F_{C.G.}$ is approximately the same as the difference between $y\,^7P_{C.G.}$ and $z\,^7P_{C.G.}$. Since $z\,^5F_{C.G.}$ is higher by about 7600 than $z\,^7P_{C.G.}$, and since, furthermore, the parameters of $(3d+4s)5p$ are considerably smaller than the corresponding parameters of $(3d+4s)^5 4p$, it is evident that $s\,^5F$ is too high to designate as the lowest term ^5F of $(3d+4s)^5 5p$.

Then, guided by the fact that due to the much smaller values of ζ_d and ζ_p for $(3d+4s)^5 5p$, the splitting of the term $3d^4(4s5p\,^3P)^5F$ should be quite small, it is probable that the experimental term $v\,^5F$ is really the lowest term ^5F of $(3d+4s)^5 5p$, i.e., $3d^4(4s5p^3P)^5F$. (It should be noted that the much larger splitting of the experimental term s^5F seems to reaffirm that it belongs to $(3d+4s)^5 4p$.) In addition, the height of $v\,^5F$ above $y\,^7P$ is very reasonable for the assignment as the lowest term ^5F of $(3d+4s)^5 5p$.

The intervals between the four experimental levels assigned to $t\,^5F$ are irregular and it is very doubtful whether these four levels belong to a single term. Thus, the experimental term $u\,^5F$ was assigned to the theoretical term $(^4G)^5F + A^3F(^3P)^5F$. There was a close correspondence between the experimental and calculated values of the levels and g-factors.

Examination of the combinations given by Kiess for t^5F, [10], indicates that the levels $t^5F_{1,2,3}$ have considerably more combinations than t^5F_4. Also, since the irregularity in the splitting of t^5F occurs for t^5F_4, the levels $t^5F_{1,2,3}$ were assigned to the previously vacant term $A^3F(^3P)^3D$. Conceivably the level t^5F_4 could be assigned to $^3H(^3P)^1G$. However, since the resulting deviation would be around -520, and since the combinations of t^5F_4 also include several quintets, the level t^5F_4 was neglected.

Below 53,800, three theoretical terms ^3G are predicted. However, below 50,000 the four experimental terms $z\,^3G$, $y\,^3G$, $x\,^3G$ and $w\,^3G$ are assigned to $(3d+4s)^5 4p$ in AEL. The experimental terms $z\,^3G$ and $y\,^3G$ fit very well the theoretical terms with the same assignments. The experimental term $w\,^3G$ corresponds very nicely to the theoretical term $A^3F(^3P)^3G$ (mean deviation -118, whereas $x\,^3G$ would yield deviations of around -1000 if assigned to $A^3F(^3P)^3G$).

Below 49,800 the only theoretical terms with no corresponding experimental terms are $A^3F(^3P)^3F$, $^3H(^3P)^1G$ and $A^3P(^3P)^1S$, all between 48,500 and 49,150. Thus, even if the level $x\,^3G_3$ is assigned to $A^3F(^3P)^3F_3$, and $x\,^3G_4$ to either $A^3F(^3P)^3F_4$ or $^3H(^3P)^1G$, the level $x\,^3G_5$ cannot be assigned to any predicted level of $(3d+4s)^5 4p$. From C. C. Kiess' paper [10], an examination of the combinations for the levels of $x\,^3G$ reveals that this term is based on 30 combinations with 12 even terms. Of these, 15 are with $x\,^3F_5$ and thus it is not reasonable to fit the levels with J equal to 3 and 4 and neglect the level having the most combinations. The assumption that $x\,^3G$ belongs to $(3d+4s)^5 5p$ is also difficult to justify. The lowest term ^3G of $(3d+4s)^5 5p$ is expected to lie much higher. Not only are the terms ^7F and ^7D of $3d^4 4s5p$ expected to be lower than $x\,^3G$, but also the levels $x\,^3G_4$ and $x\,^3G_5$ have combinations with singlets. There is also a possibility that $v\,^5F$ should actually be assigned to ^7D of $3d^4 4s5p$ and that the levels $x\,^3G$ belong to $3d^4\,^5D$ $(4s5p^3P)^5F$. Actually, however, we can only conclude that the experimental levels $x\,^3G$ can definitely not be assigned to a theorectical term ^3G of $(3d+4s)^5 4p$, and that it is not reasonable to assign the two levels $x\,^3G_3$ and $x\,^3G_4$ either to $A^3F(^3P)^3F_{3,4}$ or to $A^3F(^3P)^3F_3$ and $^3H(^3P)^1G$, and then reject the level $x\,^3G_5$. Thus, none of the levels of $x\,^3G$ was included in the least-squares calculations.

Only one of the experimental terms $w\,^3H$ and $v\,^3H$ can be assigned to the theoretical term $^3H(^1P)^3H$. Since the two experimental terms $w\,^3H$ and $v\,^3H$ are so close, their respective deviations furnish no aid in deciding which term to assign as $^3H(^1P)^3H$. Furthermore, in each case the number of combinations with even levels is 30. However, as the experimental designation of $w\,^3H$ is the same as the theoretical designation, $^3H(^1P)^3H$, and since the intervals between the calculated levels correspond much more closely to the intervals of $w\,^3H$, we assigned the levels of $w\,^3H$ to $^3H(^1P)^3H$.

Again, by remembering that the electrostatic parameters of $(3d+4s)^5 5p$ are much smaller than those of $(3d+4s)^5 4p$, it is conceivable that $v\,^3H$ should be designated as $3d^5(a\,^4G)5pv\,^3H$ i.e., as the lowest term ^3H of $(3d+4s)^5 5p$. Thus, the levels of $v\,^3H$ were not included in the least squares calculation.

The case of the two terms $v\,^3F$ and $u\,^3F$ is quite similar to that of $v\,^3H$ and $w\,^3H$. To the theoretically predicted term $(A^2D)^3F + (A^2F)^3F$ at 55,000 the term $v\,^3F$ was assigned mainly because the splitting of the theoretical term (positive intervals) is similar to the splitting of $v\,^3F$, whereas for $w\,^3F$ it is quite different (negative intervals). The deviations are then 200 cm^{-1} lower than if the levels of $u\,^3F$ were inserted. The term $u\,^3F$ is certainly high enough to belong to a term ^3F of $(3d+4s)^5 5p$. However, it is probable that $u\,^3F$ should be assigned to the second lowest ^3F term of $(3d+4s)^5 5p$, i.e., $3d^5(a\,^4G)5pu\,^3F$, since the lowest term ^3F of $(3d+4s)^5 5p$ is expected to lie below 50,000.

As for $v\,^3F$ and $u\,^3F$, the experimental term $u\,^3D$ was assigned to the theoretical term $(^4F)^3D + {}^3D(^3P)^3D$ predicted at the height, whereas the term $t\,^3D$ was neglected. Again the main consideration here was the similar splitting of the calculated term and the experimental term $u\,^3D$, whereas the splitting of $t\,^3D$ is quite different. From table 2 it is evident that the levels of $t\,^3D$ could be assigned to the theoretical levels $(^4F)^5D_{1,2,3}$ with very small deviations. However, here again it is quite probable that $t\,^3D$ should be assigned to the second lowest term ^3D of $(3d+4s)^5 5p$, i.e., $3d^5(a\,^4P)5pt\,^3D$; the levels $t\,^3D$ were, therefore, not included in the least-squares calculation.

The experimental term $t\,^3F$ cannot be assigned to a theoretical term ^3F of $(3d+4s)^5 4p$. Although the levels of $t\,^3F$ fit very nicely to $[3d^3 4s^2(^4F)4p^5G + 3d^5(^4F)4p\,^5G]_{2,3,4}$, they conceivably are levels of a term ^3F of $(3d+4s)^5 5p$, and thus were not included in the least-squares calculation. Similarly the level 3° at

61676 was not inserted although it could be assigned to either $(^4F)^5F_3^*$ or to $A^3F(^1P)^3D_3$ with small deviations.

The following changes in assignment[5] were performed:

1. AEL $d^4s(a\,^4H)py^5G \longrightarrow A^3F(^3P)y\,^5G$
2. AEL $d^5(a\,^4P)pw^5D \longrightarrow A^3F(^3P)w\,^5D$
3. $(^4G)^5F \longleftrightarrow {}^3G(^3P)^5F$
4. AEL $d^4s(c\,^4D)pu^5P \longrightarrow (^4P)u\,^5P$
5. AEL $d^4s(b\,^4G)px^5G \longrightarrow {}^3H(^3P)x\,^5G$
6. AEL $d^5(b\,^4D)pv^5D \longrightarrow (^4P)v\,^5D$
7. AEL $d^4s(c\,^4D)pt^5F_{1,2,3} \longrightarrow A^3F(^3P)^3D$
8. AEL $d^4s(a\,^4F)pw^5G \longrightarrow {}^3G(^3P)w\,^5G$
9. AEL $d^4s(b\,^4G)pw^3G \longrightarrow A^3F(^3P)w^3G$
10. AEL $d^4s(a\,^6D)5ps^5F \longrightarrow (^4D)s\,^5F$
11. AEL $d^4s(c\,^4D)pu^5D \longrightarrow (^4D)u\,^5D$
12. AEL $d^4s(a\,^4F)pw^3F \longrightarrow {}^3G(^3P)w\,^3F$
13. $(^2I)^1H \longleftrightarrow {}^3H(^3P)\,^1H$
14. AEL $d^4s(a\,^4F)pt^5D \longrightarrow {}^3D(^3P)t\,^5D$
15. AEL $d^5(a\,^2I)py^3I \longrightarrow {}^1I(^3P)y\,^3I$
16. AEL $d^5(b\,^4F)pr^5F \longrightarrow {}^3D(^3P)r\,^5F$
17. AEL $d^4s(a\,^2G)pv^3G \longrightarrow d^3s^2(^4F)^3G^*$
18. AEL $d^4s(a\,^2H)pz^1I \longrightarrow {}^1I(^3P)^3K_6$
19. AEL $d^5(a\,^2D)pv^3D \longrightarrow {}^3D(^3P)v\,^3D$
20. AEL $d^4s(c^2F)pv^3F \longrightarrow (A^2D)v\,^3F$
21. AEL $d^4s(a\,^2H)px^3I \longrightarrow (^2I)x\,^3I$
22. AEL $d^5(b\,^2H)pu^3H \longrightarrow {}^1I(^3P)u\,^3H$
23. AEL $d^5(a\,^2D)pv^3P \longrightarrow {}^3D(^3P)v\,^3P$
24. AEL $d^5(b\,^2F)pt^3F \longrightarrow d^3s^2(^4F)t\,^3F^*$
25. AEL $d^5(b\,^2H)pu^3G \longrightarrow A^3F(^1P)u\,^3G$
26. AEL $d^4s(c\,^2G)pt^3G \longrightarrow (A^2F)t\,^3G$
27. AEL $d^4s(a\,^2P)pu^3P \longrightarrow A^1S(^3P)u\,^3P$
28. AEL $d^4s(a\,^2P)pu^3D \longrightarrow (^4F)u\,^3D$
29. AEL $d^4s(a\,^2G)pr^3F \longrightarrow A^3F(^1P)r\,^3F$
30. AEL $d^4s(a\,^2G)pt^3H \longrightarrow (^2I)t\,^3H$
31. AEL $d^5(b\,^2H)pw^3I \longrightarrow {}^3H(^1P)w\,^3I$
32. AEL $d^4s(b\,^2I)pv^3I \longrightarrow (^2H)v\,^3I$
33. AEL $d^5(b\,^2F)ps^3D \longrightarrow (A^2D)s\,^3D$
34. AEL $d^4s(c\,^2G)ps^3H \longrightarrow (A^2G)s\,^3H$
35. AEL $d^5(b\,^2G)pr^3G \longrightarrow (^2H)r\,^3G$
36. AEL $d^4s(c\,^2G)pp^3F \longrightarrow (B^2F)p\,^3F$

The reasons for the changes 7 and 10 were discussed in detail previously.

Theoretically, the lowest term ^1I is predicted at 50126 with no corresponding experimental level which can be fitted to it. The next highest term ^1I is $(^2I)\,^1I$ to which corresponds the experimental term $(^2I)\,y^1I$. Thus, the experimental term $d^4s(a\,^2H)pz^1I$ at 54,800 can not be assigned to ^1I. As $z\,^1I$ is based on combinations with six even terms, [10], it is a valid level. The only possible level to which it can be assigned for J equal to 6 is $^1I(^3P)^3K_6$, yielding a deviation of only 76. This is indicated by change 18. The other changes are similar to those performed for Ti I and V I, [6], [7], reaffirming the fact that it is very difficult to predict the assignments, especially of the higher-lying terms prior to a theoretical investigation.

The level 1_3° has 16 combinations with the 7 even terms $d\,^3F$, $a\,^1G$, $b\,^3G$, $a\,^3F$, $a\,^3G$, $a\,^5G$, and $a\,^5D$, [10]. Thus, the assignment of this level to the vacant theoretical level $A^3F(^3P)^3F_3$ seems very reasonable. The deviation is only -77.

[5] For the theoretical term designations used the reader is referred to section 3 of this paper.

The level 2_1° is based on combinations with the six even terms $a\,^1H$, $b\,^3H$, $a\,^3I$, $b\,^3G$, $a\,^3G$, and $a\,^3H$, [10]. This level is assigned to the theoretical level $^3G(^3P)^3G_4$, yielding a deviation of 218.

The terms $s\,^3G$ and $q\,^3G$, given without configuration designations in AEL, are assigned to the theoretical terms whose major contributions are $(A^2G)^3G$ and $(^4F)^3G$, respectively.

Most of the experimental g-factors correspond quite closely to the calculated g-factors. However, as for V I there are some exceptions caused by unsuitably calculated eigenvectors. In general, there is very strong mixing, and especially the eigenfunctions of the higher-lying levels have a marked degree of impurity. Thus, it is very important to state the percentage composition of each level rather than just give one particular term designation (see table 2). The four experimental g-factors for levels with J equal to zero were ignored, since from the defining equation used to obtain the calculated g-factors, a g-value for a level of J equal to zero is meaningless.

Finally, some differences between the experimental data given in AEL [8], and in C. C. Kiess' paper [10], should be mentioned. Firstly, the term $t\,^5P$ is assigned as $3d^44s(a\,^6D)5pt\,^5P$ by C. C. Kiess, [10]. However, as explained before, the term $w\,^5P$ is the lowest term ^5P of $(3d+4s)^55p$. Since the term $3d^44s(a\,^6D)4py\,^5P$ is about 3000 higher than $3d^5(a\,^6S)4pz\,^5P$, we would expect that since the term $3d^5(a\,^6S)5p\,^5P$ is at 44,200, the term $3d^44s(a\,^6D)5p\,^5P$ should not be higher than 46,000 (the interaction parameters of $(3d+4s)^55p$ are about half of those for $(3d+4s)^44p$). In addition, the term $t\,^5P$ fits very nicely to the theoretical term with the same assignment as in AEL.

The term $s\,^5P$, which Kiess designates as $3d^44s(a\,^4D)5ps\,^5P$ is not given in AEL. Although there is a theoretical term ^5P predicted at that height for $(3d+4s)^54p$, we cannot assign the term $s\,^5P$ to it. Firstly, the splitting of the theoretical term $^3D(^3P)^5P$ is opposite to that of $s\,^5P$. Secondly, the assignment which Kiess gives to this term is probably correct, as it is reasonable to expect the theoretical term $3d^4(a\,^5D)(4s5p\,^3P)^5P$ at that height.

Then, Kiess also gives the three terms $3d^44s(a\,^6D)6p\,^5D$ and $3d^44s(a\,^4D)6p\,^5P$, ^5F, which are not given in AEL. The level 3_2° at 61676 in AEL is not given by Kiess, a fact which further justifies our not including this level in the least-squares. Kiess, however, gives the level 4_3° at 57142. Since this level is based on combinations with singlets, triplets, and quintets, it may perhaps be assigned to $^3D(^3P)^3F_3$. However, the resulting deviation would be about 480, and so the level 4_3° was not considered.

The rejected term $3d^5(b\,^4F)4pq\,^3F$ is designated by Kiess as $3d^5(d^2G)4pq\,^3F$. The terms $s\,^3G$ and $r\,^3G$ Kiess designates as $3d^5(b\,^2H)4ps\,^3G$ and $3d^5(b\,^2F)4pr\,^3G$, respectively, neither of which corresponds to the theoretical designations.

The term $3d^44s(a\,^2P)4pt\,^3P$, not given in AEL, fits excellently as the theoretical term $A^1D(^3P)^3P$. Since our source for the experimental data is AEL, (especially as many more experimental g-factors are given there), we did not include this term specifically

in the least-squares calculation. In table 2 the approximate values of the deviations, if this term had been inserted into the least-squares, are given in parentheses.

Below 62,100 (the limit of the experimental data inserted) there are 86 theoretical levels with no corresponding experimental levels. The lowest of these is the level $^3H(^3P)^1G$ at 48,567.

3. Table of the Observed and Calculated Levels and g-Factors

In the column "NAME" the calculated designation of the term is given. Whenever the terms of d^n have different seniorities these are denoted by the letters A and B (for d^5 ^2D by A, B, and C) the lower calculated term being designated by A. Whenever a calculated term has a corresponding experimental term the small letters z, y, x, . . . are used as in AEL. The terms of d^4sp are denoted by $d^4v_1S_1L_1(sp^1, {}^3P)SL$. The terms of d^5p are differentiated from those of d^3s^2p by using a star for the latter terms.

The entries in the columns "J", "OBS. LEVEL cm^{-1}," "CALC. LEVEL cm^{-1}," are self-evident. In the column "PERCENTAGE" for each calculated level either the three highest contributions or all those contributions exceeding seven percent are given.

Whenever the experimental and calculated term designations differ, the experimental designation is entered in the column "AEL", using the notation of C. E. Moore, [8]. In many instances the exchanges involve complete terms rather than isolated levels. Unless specified otherwise, the entries in the column "AEL" pertain to exchanges in terms.

The columns "OBS.g-FACTOR", "CALC.g-FACTOR" give the observed and calculated values of the g-factors, respectively.

The entries are in the order of increasing energy of the calculated terms.

TABLE 2. *Observed and calculated levels of* Cr I $(3d+4s)^5$4p

Name	J	Percentage	AEL		Obs. level (cm^{-1})	Calc. level (cm^{-1})	O–C	Obs. g-factor	Calc. g-factor
			Config.	Desig.					
$(^6S)^7P$	2	$69+31\,^5D(^3P)^7P$			23305	23134	171	2.334	2.332
	3	$70+30\,^5D(^3P)^7P$			23386	23239	147	1.92	1.916
	4	$71+29\,^5D(^3P)^7P$			23499	23385	114	1.752	1.750
$^5D(^3P)^7F$	0	100	$3d^44s(a\,^6D)4p$	$z\,^7F$	24971	25034	−63		
	1	100			25011	25074	−63	1.52	1.500
	2	100			25089	25152	−63	1.50	1.500
	3	100			25206	25268	−62	1.49	1.500
	4	100			25360	25422	−62	1.51	1.500
	5	100			25549	25610	−61	1.51	1.500
	6	100			25771	25833	−62	1.53	1.500
$(^6S)^5P$	1	92			26802	26759	43	2.512	2.500
	2	91			26796	26720	76	1.830	1.843
	3	92			26788	26673	115	1.670	1.670
$^5D(^3P)^7D$	1	99	$3d^44s(a\,^6D)4p$	$z\,^7D$	27300	27390	−90	3.01	2.993
	2	$66+23\,^5D(^3P)^7P+10(^6S)^7P$			27382	27438	−56	1.99	2.110
	3	$58+29\,^5D(^3P)^7P+12(^6S)^7P$			27500	27562	−62	1.76	1.817
	4	$58+30\,^5D(^3P)^7P+12(^6S)^7P$			27650	27723	−73	1.66	1.692
	5	100			27825	27960	−135	1.61	1.599
$^5D(^3P)^7P$	2	$44+34\,^5D(^3P)^7D+21(^6S)^7P$	$3d^44s(a\,^6D)4p$	$y\,^7P$	27729	27366	363	2.341	2.212
	3	$40+41\,^5D(^3P)^7D+18(^6S)^7P$			27820	27497	323	1.929	1.845
	4	$41+42\,^5D(^3P)^7D+17(^6S)^7P$			27935	27654	281	1.761	1.708
$^5D(^3P)^5P$	1	95	$3d^44s(a\,^6D)4p$	$y\,^5P$	29421	29266	155	2.513	2.504
	2	95			29585	29448	137	1.836	1.834
	3	96			29825	29718	107	1.669	1.667
$^5D(^3P)^5F$	1	96	$3d^44s(a\,^6D)4p$	$z\,^5F$	30787	30787	0	0.002	0.001
	2	96			30859	30860	−1	0.997	1.000
	3	96			30965	30968	−3	1.245	1.250
	4	95			31106	31113	−7	1.345	1.356
	5	96			31280	31293	−13	1.396	1.400

TABLE 2. *Observed and calculated levels of* Cr I $(3d+4s)^5 4p$ – Continued

Name	J	Percentage	AEL		Obs. level (cm^{-1})	Calc. level (cm^{-1})	O–C	Obs. g-factor	Calc. g-factor
			Config.	Desig.					
$^5D(^3P)^5D$	0	$89+8\,^5D(^3P)^3P$	$3d^44s(a\,^6D)4p$	$z\,^5D$	33338	33353	−15		
	1	93			33424	33420	4	1.499	1.500
	2	96			33542	33528	14	1.497	1.500
	3	97			33672	33665	7	1.497	1.499
	4	97			33816	33828	−12	1.499	1.499
$^5D(^3P)^3P$	0	$88+8\,^5D(^3P)^5D$	$3d^44s(a\,^4D)4p$	$z\,^3P$	33763	33900	−137		
	1	92			33897	34059	−162	1.49	1.500
	2	95			34190	34383	−193	1.55	1.499
$^5D(^3P)^3F$	2	95	$3d^44s(a\,^4D)4p$	$z\,^3F$	35898	35825	73		0.668
	3	95			36034	35976	58		1.084
	4	95			36212	36177	35		1.250
$^5D(^3P)^3D$	1	96	$3d^44s(a\,^4D)4p$	$z\,^3D$	38597	38605	−8		0.500
	2	96			38731	38751	−20		1.166
	3	96			38911	38948	−37		1.333
$^5D(^1P)^5F$	1	$84+12(^4G)^5F$	$3d^44s(a\,^4D)4p$	$y\,^5F$	40906	40791	115	0.004	0.005
	2	$83+12(^4G)^5F$			40971	40872	99	1.28	1.003
	3	$83+12(^4G)^5F$			41086	40994	92	1.246	1.251
	4	$82+13(^4G)^5F$			41225	41154	71	1.360	1.350
	5	$82+14(^4G)^5F$			41393	41350	43		1.400
$^5D(^1P)^5D$	0	$52+14(^4P)^5D$	$3d^44s(a\,^4D)4p$	$y\,^5D$	41225	41373	−148		
	1	$54+14(^4P)^5D$			41289	41440	−151	1.503	1.501
	2	$56+13(^4P)^5D$			41409	41572	−163	1.504	1.501
	3	$58+13(^4P)^5D$			41575	41766	−191	1.503	1.500
	4	$62+14(^4P)^5D$			41782	42023	−241	1.500	1.499
$^5D(^1P)^5P$	1	$68+7(^4P)^5P$	$3d^44s(a\,^4D)4p$	$x\,^5P$	(40930)	42367		(2.455)	2.441
	2	$56+7(^4P)^5P$			(40983)	42471		(1.76)	1.782
	3	$55+8(^4P)^5P$			(41043)	42635		(1.640)	1.627
$^3H(^3P)^5H$	3	$61+20(^4G)^5H$	$3d^44s(a\,^4H)4p$	$z\,^5H$	42026	42330	−304		0.530
	4	$55+19(^4G)^5H$			42080	42378	−298		0.938
	5	$48+17(^4G)^5H$			42154	42444	−290		1.142
	6	$38+25(^4G)^5G+14(^4G)^5H$			42252	42531	−279		1.263
	7	$65+24(^4G)^5H$			42387	42724	−337		1.285
$A^3P(^3P)^5D$	0	$49+26\,^5D(^1P)^5D$	$3d^44s(b\,^4P)4p$	$x\,^5D$	42218	42152	66		
	1	$47+26\,^5D(^1P)^5D$			42293	42215	78	1.501	1.553
	2	$43+21\,^5D(^1P)^5D$			42439	42343	96	1.494	1.554
	3	$40+22\,^5D(^1P)^5D$			42648	42543	105	1.498	1.533
	4	$45+20\,^5D(^1P)^5D$			42909	42841	68	1.497	1.498
$(^4G)^5G$	2	$61+20\,^3H(^3P)^5G$			42515	42552	−37	0.35	0.336
	3	$57+19\,^3H(^3P)^5G$			42539	42587	−48		0.892
	4	$53+18\,^3H(^3P)^5G$			42565	42627	−62		1.114
	5	$47+16\,^3H(^3P)^5G$			42589	42669	−80	1.23	1.225
	6	$37+27\,^3H(^3P)^5H+13\,^3H(^3P)^5G$			42606	42708	−102	1.32	1.284
$A^3P(^3P)^5S$	2	$46+46(^4P)^5S$	$3d^44s(b\,^4P)4p$	$z\,^5S$	43125	42919	206	1.96	1.984

TABLE 2. *Observed and calculated levels of* Cr I $(3d+4s)^5 4p$—Continued

Name	J	Percentage	AEL		Obs. level (cm^{-1})	Calc. level (cm^{-1})	O–C	Obs. g-factor	Calc. g-factor
			Config.	Desig.					
$^3H(^3P)^5I$	4	99	$3d^4 4s(a\,^4H)4p$	$z\,^5I$	44247	44009	238		0.603
	5	99			44308	44108	200		0.903
	6	99			44393	44224	169		1.073
	7	99			44514	44354	160		1.179
	8	100			44667	44496	171		1.250
$A^3F(^3P)^5G$	2	85	$3d^4 4s(a\,^4H)4p$	$y\,^5G$	44300	44505	−205	0.35	0.359
	3	80			44373	44562	−189	0.93	0.948
	4	$68+18A^3F(^3P)^5F$			44534	44636	−102		1.190
	5	$46+29A^3F(^3P)^5F$			44591	44723	−132	1.25	1.325
	6	$85+5^3G(^3P)^5G$			44746	44938	−192	1.34	1.329
$A^3P(^3P)^5P$	1	$78+8(^4D)^5P$	$3d^4 4s(b\,^4P)4p$	$v\,^5P$	44667	44683	−16	2.47	2.481
	2	$76+9(^4D)^5P$			44875	44938	−63		1.827
	3	$70+13(^4D)^5P$			45113	45172	−59	1.65	1.658
$A^3F(^3P)^5F$	1	$66+28(^4G)^5F$	$3d^4 4s(a\,^4F)4p$	$x\,^5F$	45202	44759	443		0.003
	2	$63+27(^4G)^5F$			45225	44784	441		0.975
	3	$58+26(^4G)^5F$			45256	44818	438		1.215
	4	$50+23(^4G)^5F$			45286	44856	430		1.305
	5	$34+37A^3F(^3P)^5G$			45306	44895	411	1.41	1.336
$(^4G)^3H$	4	$59+25(^4G)^5H$			45359	45722	−363		0.834
	5	$49+32(^4G)^5H$			45354	45582	−228		1.064
	6	$68+16(^4G)^5H$			45349	45586	−237		1.179
$(^4G)^5H$	3	$76+22^3H(^3P)^5H$			45566	45573	−7	0.52	0.505
	4	$51+28(^4G)^3H+15^3H(^3P)^5H$			45615	45577	38		0.870
	5	$43+38(^4G)^3H+13^3H(^3P)^5H$			45663	45770	−107		1.071
	6	$58+20(^4G)^3H$			45707	45812	−105		1.204
	7	$74+25^3H(^3P)^5H$			45741	45834	−93	1.29	1.285
$(^4P)^3P$	0	$39+31A^3P(^3P)^3P$			45723	45803	−80		
	1	$45+24A^3P(^3P)^3P$			45719	45787	−68		1.515
	2	$49+20A^3P(^3P)^3P$			45734	45821	−87		1.431
$(^4G)^3F$	2	$75+8A^3F(^3P)^3F$			45966	45933	33		0.737
	3	$80+8A^3F(^3P)^3F$			46000	45981	19		1.090
	4	$83+7A^3F(^3P)^3F$			46058	46051	7		1.249
$A^3F(^3P)^5D$	0	$40+25A^3P(^3P)^5D$	$3d^5(a\,^4P)4p$	$w\,^5D$	46081	46068	13		
	1	$42+20A^3P(^3P)^5D$			46298	46058	240		1.352
	2	$40+22A^3P(^3P)^5D$			46350	46088	262		1.410
	3	$36+27A^3P(^3P)^5D$			46368	46170	198		1.440
	4	$39+34A^3P(^3P)^5D$			46422	46325	97		1.460
$(^4P)^3D$	1	$22+19(^4D)^5F+14^3G(^3P)^5F$			46077	46364	−287		0.429
	2	$23+14(^4D)^5F+11^3G(^3P)^5F$			46109	46440	−331	1.24	1.172
	3	$37+15A^3F(^3P)^5D$			46174	46463	−289	1.33	1.352
$^3G(^3P)^5F$	1	$21+18(^4D)^5F+20(^4P)^3D$	$3d^5(a\,^4G)4p$	$w\,^5F$	46678	46638	40		0.405
	2	$20+18(^4D)^5F+23(^4P)^3D$			46677	46624	53		1.048
	3	$23+22(^4D)^5F+11(^4P)^3D$			46688	46602	86	1.25	1.227
	4	$23+24(^4D)^5F+15A^3F(^3P)^5D$			46721	46623	98		1.336
	5	$33+30(^4D)^5F+9^3D(^3P)^5F$			46705	46596	109	1.37	1.362

TABLE 2. *Observed and calculated levels of* Cr I $(3d+4s)^5 4p$—Continued

Name	J	Percentage	AEL		Obs. level (cm^{-1})	Calc. level (cm^{-1})	O–C	Obs. g-factor	Calc. g-factor
			Config.	Desig.					
$^3H(^3P)^3G$	3	$42+20A^3F(^3P)^3G$	$3d^4 4s(a\,^4H)4p$	$z\,^3G$	46847	46737	110		0.775
	4	$40+21A^3F(^3P)^3G$			46905	46786	119		1.077
	5	$34+20(^4G)^3G$			46986	46840	146		1.223
$A^3P(^3P)^3S$	1	$72+8(^4P)^3S$	$3d^4 4s(b\,^4P)4p$	$z\,^3S$	47088	46763	325		1.810
$(^4P)^5P$	1	$55+20(^4D)^5P+13^3D(^3P)^5P$	$3d^4 4s(c\,^4D)4p$	$u\,^5P$	47022	47171	−149	2.43	2.475
	2	$51+20(^4D)^5P+13^3D(^3P)^5P$			46968	47081	−113	1.83	1.814
	3	$47+20(^4D)^5P+13^3D(^3P)^5P$			46879	46943	−64	1.68	1.654
$(^4G)^3G$	3	$73+12^3H(^3P)^3G$			47048	47118	−70		0.748
	4	$69+16^3H(^3P)^3G$			47055	47149	−94		1.050
	5	$62+24^3H(^3P)^3G$			47055	47188	−133		1.201
$^3H(^3P)^5G$	2	$67+15(^4G)^5G$	$3d^4 4s(b\,^4G)4p$	$x\,^5G$	47047	47022	25	0.45	0.389
	3	$62+14(^4G)^5G$			47126	47085	41	0.96	0.949
	4	$60+15(^4G)^5G$			47190	47144	46		1.172
	5	$63+16(^4G)^5G$			47229	47187	42	1.27	1.279
	6	$70+19(^4G)^5G$			47222	47192	30	1.44	1.333
$^3H(^3P)^3I$	5	$61+28^3G(^3P)^5H$	$3d^4 4s(a\,^4H)4p$	$z\,^3I$	47586	47640	−54		0.929
	6	$57+34^3G(^3P)^5H$			47630	47674	−44		1.099
	7	$52+40^3G(^3P)^5H$			47693	47731	−38		1.206
$^3G(^3P)^5H$	3	$79+12^3H(^3P)^5H$	$3d^4 4s(b\,^4G)4p$	$x\,^5H$	47621	47553	68		0.522
	4	$82+11^3H(^3P)^5H$			47689	47628	61		0.909
	5	$56+30^3H(^3P)^3I$			47794	47771	23		1.014
	6	$53+35^3H(^3P)^3I$			47942	47940	2		1.143
	7	$49+42^3H(^3P)^3I$			48140	48142	−2		1.222
$(^4P)^5D$	0	$46+27A^3F(^3P)^5D$	$3d^5(b\,^4D)4p$	$v\,^5D$	47788	47835	−47		
	1	$49+26A^3F(^3P)^5D$			47772	47877	−105	1.37	1.468
	2	$49+26A^3F(^3P)^5D$			47786	47938	−152	1.39	1.469
	3	$49+25A^3F(^3P)^5D$			47814	48025	−211	1.53	1.474
	4	$52+23A^3F(^3P)^5D$			47866	48149	−283	1.50	1.479
$(^4G)^5F$	1	$15+15A^3P(^3P)^3P+9A^3F(^3P)^5F$	$3d^4 4s(b\,^4G)4p$	$u\,^5F$	47878	47998	−120	0.00	0.459
	2	$35+19A^3F(^3P)^5F$			47918	48054	−136	1.04	1.029
	3	$35+20A^3F(^3P)^5F$			47975	48151	−176	1.36	1.329
	4	$39+23A^3F(^3P)^5F$			48014	48371	−357		1.360
	5	$39+25A^3F(^3P)^5F$			47986	48351	−365	1.38	1.385
$A^3F(^3P)^3D$	1	$59+7(^4G)^5F$	$3d^4 4s(c\,^4D)4p$	$t\,^5F$	48210	48407	−197		0.627
	2	$61+6(^4G)^5F$			48218	48382	−164		1.164
	3	$64+5(^4G)^5F$			48252	48379	−127		1.266
$A^3P(^3P)^3P$	0	$29+24(^4P)^3P+11A^3P(^3P)^1S$	$3d^4 4s(b\,^4P)4p$	$x\,^3P$	48226	48133	93		
	1	$28+15(^4P)^3P+15(^4G)^5F$			48331	48413	−82		0.943
	2	$42+19(^4P)^3P$			48459	48508	−49		1.481
$^3H(^3P)^3H$	4	$76+4(^4G)^3H$	$3d^4 4s(a\,^4H)4p$	$y\,^3H$	48288	48177	111		0.820
	5	89			48310	48308	2		1.042
	6	83			48445	48440	5		1.165
$^3H(^3P)^1G$	4	$32+21A^3F(^3P)^1G$				48567			1.067

TABLE 2. *Observed and calculated levels of* Cr I $(3d+4s)^5 4p$—Continued

Name	J	Percentage	AEL		Obs. level (cm^{-1})	Calc. level (cm^{-1})	O–C	Obs. g-factor	Calc. g-factor
			Config.	Desig.					
$A^3F(^3P)^3F$	2	$59+16^3G(^3P)^3F$				48650			0.659
	3	$60+15^3G(^3P)^3F$		1°	48636	48713	−77		1.068
	4	$38+18^3H(^3P)^1G$				48925			1.155
$A^3P(^3P)^1S$	0	$74+19A^3P(^3P)^3P$				49153			
$A^3P(^3P)^3D$	1	$38+20(^4P)^3D$	$3d^4 4s(b\,^4P)4p$	$x\,^3D$	48840	49107	−267		0.535
	2	$46+14(^4P)^3D$			49028	49220	−192		1.165
	3	$61+7(^4P)^3D$			49311	49368	−57		1.278
$^3G(^3P)^5G$	2	$65+18(^4G)^5G$	$3d^4 4s(a\,^4F)4p$	$w\,^5G$	49467	49358	109		0.373
	3	$53+14(^4G)^5G$			49520	49373	147	1.04	0.923
	4	$63+19(^4G)^5G$			49573	49430	143		1.140
	5	$70+17(^4G)^5G$			49618	49565	113		1.264
	6	$73+17(^4G)^5G$			49635	49590	45	1.35	1.328
$A^3F(^3P)^3G$	3	$40+12^3G(^3P)^5G+9^3H(^3P)^3G$	$3d^4 4s(b\,^4G)4p$	$w\,^3G$	49371	49498	−127		0.807
	4	$40+13^3H(^3P)^3G$			49454	49583	−129		1.073
	5	$51+17^3H(^3P)^3G$			49538	49637	−99		1.202
$(^4P)^5S$	2	$30+31A^3P(^3P)^5S+15(^4D)^5P$			49823	49512	311	2.00	1.915
$(^4D)^5P$	1	$46+30(^4P)^5P+12^3D(^3P)^5P$			49589	49601	−12	2.48	2.476
	2	$14+20A^3F(^3P)^1D+11(^4P)^5P$			49598	49822	−224	1.88	1.456
	3	$31+26(^4P)^5P$			49812	49878	−66	1.77	1.588
$(^4D)^3F$	2	$37+18^3G(^3P)^3F$			49653	49702	−49		0.751
	3	$43+18^3G(^3P)^3F$			49650	49679	−29		1.141
	4	$56+15^3G(^3P)^3F$			49621	49651	−30		1.252
$(^4P)^3S$	1	$73+17A^3P(^3P)^3S$			49477	49821	−344		1.954
$A^3F(^3P)^1D$	2	$31+11(^4D)^5P$				49839			1.342
$(^4D)^3D$	1	$66+11(^4P)^3D$			50106	49965	141		0.487
	2	$57+14(^4P)^3D$			50184	50081	103		1.149
	3	$51+18(^4P)^3D$			50264	50206	58		1.346
$A^3P(^3P)^1P$	1	86				50125			0.982
$^3H(^3P)^1I$	6	$88+5^3G(^3P)^3H$				50126			1.013
$(^4D)^5F$	1	$44+29^3G(^3P)^5F+10(^4G)^5F$	$3d^4 4s(a\,^6D)5p$	$s\,^5F$	50019	50058	−39		0.051
	2	$43+29^3G(^3P)^5F+10(^4G)^5F$			50058	50112	−54		1.022
	3	$44+29^3G(^3P)^5F+9(^4G)^5F$			50102	50186	−84	1.27	1.258
	4	$30+29(^4D)^5D+21^3G(^3P)^5F$			50211	50237	−26	1.25	1.401
	5	$46+33^3G(^3P)^5F$			50253	50296	−43	1.39	1.395
$(^4D)^5D$	0	$69+10(^4P)^5D$	$3d^4 4s(c\,^4D)4p$	$u\,^5D$	50661	50455	206		
	1	$71+9(^4P)^5D$			50663	50476	187	1.46	1.514
	2	$68+8(^4P)^5D$			50655	50484	171	1.51	1.510
	3	$60+7(^4P)^5D$			50628	50467	161	1.54	1.507
	4	$44+15(^4D)^5F$			50558	50336	222	1.54	1.437
$A^3F(^3P)^1F$	3	$58+12^3D(^3P)^1F$				50858			0.996

TABLE 2. *Observed and calculated levels of* Cr I $(3d+4s)^5 4p$ – Continued

Name	J	Percentage	AEL		Obs. level (cm^{-1})	Calc. level (cm^{-1})	O–C	Obs. g-factor	Calc. g-factor
			Config.	Desig.					
$^3G(^3P)^3H$	4	$77+7^3H(^3P)^3H$				50801			0.806
	5	$67+10^3H(^3P)^1H$				50893			1.031
	6	$76+6^3H(^3P)^1I$				51084			1.157
$^3G(^3P)^3F$	2	$41+27(^4D)^3F$	$3d^44s(a\,^4F)4p$	$w\,^3F$	50890	50919	−29		0.683
	3	$42+26(^4D)^3F$			50950	50994	−44		1.092
	4	$46+23(^4D)^3F$			51060	51102	−42		1.251
$^3H(^3P)^1H$	5	$68+11(^2I)^1H$	$3d^5(a\,^2I)4p$	$z\,^1H$	51401	50998	403		1.006
$(^4D)^3P$	0	$71+11A^3P(^3P)^3P$			51177	50965	212		
	1	$68+8A^3P(^3P)^3P$			51247	51069	178		1.527
	2	$45+32A^3P(^3P)^1D$			51287	51073	214		1.319
$A^3P(^3P)^1D$	2	$57+27(^4D)^3P$				51311			1.185
$^3D(^3P)^5D$	0	94	$3d^44s(a\,^4F)4p$	$t\,^5D$	52000	52113	−113		
	1	94			52003	52115	−112		1.494
	2	93			52012	52122	−110		1.495
	3	92			52032	52138	−106		1.496
	4	92			52064	52167	−103		1.497
$A^3F(^3P)^1G$	4	$56+22^3H(^3P)^1G$				52262			0.980
$^3G(^3P)^3G$	3	$69+15^3H(^3P)^3G$				52459			0.773
	4	$72+14^3H(^3P)^3G$		2°	52720	52502	218		1.053
	5	$53+14^3G(^3P)^1H$				52490			1.135
$^1I(^3P)^3I$	5	$48+33(^2I)^3I$	$3d^5(a\,^2I)4p$	$y\,^3I$	52592	52583	9		0.893
	6	$58+39(^2I)^3I$			52661	52620	41		1.025
	7	$59+39(^2I)^3I$			52678	52641	37		1.143
$^3G(^3P)^1H$	5	$67+10^3H(^3P)^1H$				52811			1.008
$^3G(^3P)^1F$	3	$63+21A^3F(^3P)^1F$				52903			0.985
$A^1G(^3P)^3H$	4	$47+26(^2I)^3H$	$3d^44s(b\,^4G)4p$	$x\,^3H$	52963	53169	−206		0.837
	5	$57+27(^2I)^3H$			52885	53136	−251		1.034
	6	$68+26(^2I)^3H$			52915	53162	−247		1.166
$^3D(^3P)^5F$	1	$85+6(^4D)^5F$	$3d^5(b\,^4F)4p$	$r\,^5F$	53012	53116	−104		0.008
	2	$84+6(^4D)^5F$			53038	53138	−100		1.004
	3	$83+6(^4D)^5F$			53074	53167	−93		1.252
	4	$81+6(^4D)^5F$			53118	53200	−82		1.336
	5	$85+7(^4D)^5F$			53172	53236	−64	1.42	1.399
$A^1G(^3P)^3F$	2	$59+15(A^2F)^3F$				53690			0.674
	3	$60+14(A^2F)^3F$				53567			1.082
	4	$62+11(A^2F)^3F$				53434			1.245
$(^4F)^3G^*$	3	$28+22(^4F)^3G$	$3d^44s(a\,^2G)4p$	$v\,^3G$	53805	53736	69		0.758
	4	$26+22(^4F)^3G$			53928	53873	55		1.044
	5	$25+22(^4F)^3G$			54078	54063	15		1.188
$(A^2D)^1D$	2	$32+30(A^2F)^1D$				53969			1.036

TABLE 2. *Observed and calculated levels of* Cr I (3d+4s)^{5}4p – Continued

Name	J	Percentage	AEL		Obs. level (cm^{-1})	Calc. level (cm^{-1})	O–C	Obs. g-factor	Calc. g-factor
			Config.	Desig.					
$(A^2D)^3P$	0	$29+26A^1S(^3P)^3P$				54161			
	1	$17+14A^1S(^3P)^3P+13(^4F)^3D^*$				54164			1.022
	2	$25+17A^1S(^3P)^3P+16^3D(^3P)^3P$				54201			1.402
$(^2I)^3K$	6	$56+42^1I(^3P)^3K$			54317	54213	104		0.860
	7	$54+46^1I(^3P)^3K$			54405	54316	89		1.018
	8	$59+41^1I(^3P)^3K$			54498	54376	122		1.125
$(^4F)^3D^*$	1	$16+13A^1S(^3P)^3P$				54299			0.979
	2	$26+24A^3P(^3P)^3D$				54595			1.211
	3	$12+12A^3P(^3P)^3D+11(A^2D)^3F$				54914			1.170
$^3D(^3P)^5P$	1	$71+23(^4D)^5P$				54504			2.495
	2	$69+23(^4D)^5P$				54390			1.812
	3	$71+24(^4D)^5P$				54207			1.664
$^3H(^1P)^3H$	4	$42+20(^2I)^3H+18A^1G(^3P)^3H$	$3d^44s(a\,^2H)4p$	$w\,^3H$	54737	54484	253		0.816
	5	$41+21(^2I)^3H+17A^1G(^3P)^3H$			54799	54558	241		1.048
	6	$42+24(^2I)^3H+17A^1G(^3P)^3H$			54887	54608	279		1.156
$(A^2D)^3F$	2	$30+20(A^2F)^3F$	$3d^44s(c\,^2F)4p$	$v\,^3F$	54993	54708	285		0.720
	3	$22+15(A^2F)^3F+10(A^2D)^3D$			55102	54840	262		1.081
	4	$30+19^3G(^3P)^1G+18(A^2F)^3F$			55207	54954	253		1.163
$^1I(^3P)^3K$	6	$55+40(^2I)^3K$	$3d^44s(a\,^2H)4p$	$z\,^1I$	54800	54724	76		0.869
	7	$46+36(^2I)^3K+17(^2I)^1K$				54808			1.015
	8	$59+41(^2I)^3K$				54899			1.125
$A^1G(^3P)^3G$	3	$41+19(A^2F)^3G$				54897			0.895
	4	$33+17^3G(^3P)^1G$				54868			1.081
	5	$60+19(A^2F)^3G$				55053			1.197
$(^2I)^1K$	7	$79+10(^2I)^3K$			54970	54973	−3		1.005
$(A^2D)^1F$	3	$26+18(A^2F)^1F+9(^4F)^3D^*$				55090			1.085
$^3G(^3P)^1G$	4	$39+25A^1G(^3P)^3G$				55095			1.044
$^3D(^3P)^3D$	1	$33+28(A^2D)^3D$	$3d^5(a\,^2D)4p$	$v\,^3D$	54957	55179	−222		0.514
	2	$30+26(A^2D)^3D$			55153	55109	44		1.147
	3	$30+19(A^2D)^3D$			55452	55067	385		1.259
$(^2I)^1I$	6	$35+28^1I(^3P)^3H$			55517	55759	−242		1.077
$(^2I)^3I$	5	$29+30^1I(^3P)^3I+28^3H(^3P)^3I$	$3d^44s(a\,^2H)4p$	$x\,^3I$	55686	55709	−23		0.860
	6	$34+30^1I(^3P)^3I+25^3H(^3P)^3I$			55741	55818	−77		1.209
	7	$39+32^1I(^3P)^3I+24^3H(^3P)^3I$			55799	55861	−62		1.142
$(^2I)^1H$	5	$43+12^3G(^3P)^1H+9^1I(^1P)^1H$	$3d^44s(a\,^2H)4p$	$y\,^1H$	55945	55824	121		0.982
$(A^2F)^3D$	1	$30+14(^4F)^3D^*+13(A^2D)^1P$				55937			0.621
	2	$31+17A^3F(^3P)^3D+13(^4F)^3D^*$				56058			1.180
	3	$31+16A^3F(^3P)^3D+11(^4F)^3D^*$				56080			1.278
$^1I(^3P)^3H$	4	$67+12(^2H)^3H$	$3d^5(b\,^2H)4p$	$u\,^3H$	55916	56038	−122		0.802
	5	$61+12(^2H)^3H$			55875	55993	−118		1.030
	6	$37+37(^2I)^1I$			55908	56049	−141		1.083

TABLE 2. *Observed and calculated levels of* Cr I $(3d+4s)^5 4p$ — Continued

Name	J	Percentage	AEL		Obs. level (cm^{-1})	Calc. level (cm^{-1})	O–C	Obs. g-factor	Calc. g-factor
			Config.	Desig.					
$(^4F)^5G$	2	$46+44(^4F)^5G^*$			56155	56119	36		0.353
	3	$43+38(^4F)^5G^*$			56210	56196	14		0.962
	4	$51+40(^4F)^5G^*$			56280	56321	−41		1.151
	5	$55+38(^4F)^5G^*$			56362	56455	−93		1.266
	6	$59+34(^4F)^5G^*$			56449	56600	−151		1.333
$^3D(^3P)^3P$	0	$56+19(A^2D)^3P$	$3d^5(a\,^2D)4p$	$v\,^3P$	56802	56537	265		
	1	$40+10^3D(^3P)^1P$			56723	56364	359		1.306
	2	$42+18(A^2D)^3P$			56592	56291	301		1.449
$(A^2D)^1P$	1	$26+20^3D(^3P)^1P$				56560			1.065
$^3D(^3P)^3F$	2	$36+20(^4F)^3F$				56624			0.687
	3	$43+18(^4F)^3F$				56663			1.088
	4	$31+29(A^2F)^1G$				56584			1.150
$(A^2F)^1G$	4	$45+22^3D(^3P)^3F$				56855			1.114
$(^4F)^3F^*$	2	$14+24^3D(^3P)^3F$	$3d^5(b\,^2F)4p$	$t\,^3F$	57221	57036	185		0.672
	3	$10+10(^4F)^3F+9^3D(^3P)^3F$			57276	57200	76		0.924
	4	$13+16(^4F)^3F+15(A^2F)^3G$			57335	57324	11		1.180
$A^3F(^1P)^3G$	3	$21+16^3D(^3P)^3F+9^3H(^3P)^3G$	$3d^5(b\,^2H)4p$	$u\,^3G$	56986	57044	−58		0.921
	4	$24+15^3H(^3P)^3G+12(A^2F)^3G$			57034	57153	−119		1.125
	5	$25+23^3H(^3P)^3G+22(A^2F)^3G$			57088	57297	−209		1.218
$A^1S(^3P)^3P$	0	$40+22(A^2D)^3P+18A^3P(^3P)^3P$	$3d^4 4s(a\,^2P)4p$	$u\,^3P$	57155	57313	−158		
	1	$40+21(A^2D)^3P+16A^3P(^3P)^3P$			57133	57319	−186		1.482
	2	$43+22(A^2D)^3P+11A^3P(^3P)^3P$			57088	57293	−205		1.475
$(^4F)^5F$	1	$69+14(^4F)^5F^*$				57483			0.026
	2	$70+13(^4F)^5F^*$				57504			1.005
	3	$57+10(^4F)^5F^*$				57518			1.169
	4	$53+16(A^2F)^3G+8(^4F)^5F^*$				57609			1.293
	5	$62+9(^4F)^5F^*$				57635			1.360
$(A^2F)^3G$	3	$40+14(^4F)^5F+11(A^2F)^3F$	$3d^4 4s(c\,^2G)4p$	$t\,^3G$	57557	57591	−34		0.919
	4	$21+18(^4F)^5F+14(A^2F)^3F$			57587	57526	61		1.174
	5	$58+20A^3F(^3P)^3G$			57702	57788	−86		1.216
$A^1D(^3P)^3D$	1	$41+20^3D(^3P)^3D$				57815			0.502
	2	$30+14(A^2F)^3F+12(A^2D)^3F$				57954			0.957
	3	$39+16^3D(^3P)^3D$				58058			1.269
$(A^2F)^3F$	2	$26+24A^1D(^3P)^3D+15(A^2D)^3F$	$3d^5(a\,^2D)4p$	$s\,^3F$	58163	57900	263		0.892
	3	$25+23(A^2D)^3F+20(A^2F)^3G$			58203	57993	210		1.071
	4	$25+23(A^2F)^3G+20(A^2D)^3F$			58168	58069	99		1.170
$A^1D(^3P)^3F$	2	$56+25(A^2G)^3F$				58655			0.679
	3	$50+19(A^2G)^3F$				58658			1.089
	4	$48+16(A^2G)^3F+16(^4F)^5D$				58747			1.299
$^3D(^3P)^1F$	3	$29+24(A^2F)^1F$				58927			1.104

TABLE 2. *Observed and calculated levels of* Cr I (3d+4s)^{5}4p—Continued

Name	J	Percentage	AEL		Obs. level (cm^{-1})	Calc. level (cm^{-1})	O–C	Obs. g-factor	Calc. g-factor
			Config.	Desig.					
(^{4}F)^{5}D	0	75+8(^{4}F)^{5}D*				58939			
	1	42+15(^{4}F)^{3}D				58912			1.136
	2	75+6(^{4}F)^{5}D*				58966			1.480
	3	69+5(^{4}F)^{5}D*				58955			1.456
	4	60+13A^{1}D(^{3}P)^{3}F				59028			1.435
(^{2}I)^{3}H	4	16+23(^{2}H)^{3}H+16^{1}I(^{3}P)^{3}H	$3d^44s(a\,^2G)4p$	$t\,^3$H	58728	58950	−222		0.818
	5	17+24(^{2}H)^{3}H+16^{1}I(^{3}P)^{3}H			58755	58986	−231		1.038
	6	17+26(^{2}H)^{3}H+16^{1}I(^{3}P)^{3}H			58775	59016	−241		1.165
(^{4}F)^{3}D	1	18+33(^{4}F)^{5}D+13^{3}D(^{3}P)^{1}P	$3d^44s(a\,^2P)4p$	$u\,^3$D	58725	58945	−220		1.041
	2	39+28^{3}D(^{3}P)^{3}D+15(A^{2}D)^{3}D			58860	59138	−278		1.157
	3	25+25^{3}D(^{3}P)^{3}D			59122	59292	−170		1.248
^{3}D(^{3}P)^{1}P	1	29+25(A^{2}D)^{1}P+16(^{4}F)^{3}D				59396			0.815
A^{3}F(^{1}P)^{3}F	2	51+11(^{4}F)^{3}F	$3d^44s(a\,^2G)4p$	$r\,^3$F	59358	59316	42		0.692
	3	46+9(^{4}F)^{3}F			59417	59415	2		1.079
	4	50+9(^{4}F)^{3}F			59488	59457	31		1.240
(A^{2}F)^{1}D	2	42+18^{3}D(^{3}P)^{1}D+14A^{3}F(^{3}P)^{1}D				59493			0.989
^{3}H(^{1}P)^{3}I	5	64+16(^{2}H)^{3}I+10(^{2}I)^{3}I	$3d^5(b\,^2H)4p$	$w\,^3$I	59806	59650	156		0.848
	6	74+13(^{2}I)^{3}I+9(^{2}H)^{3}I			59884	59808	76		1.026
	7	77+13(^{2}I)^{3}I+7(^{2}H)^{3}I			59957	59947	10		1.143
(^{2}H)^{3}I	5	50+16(A^{2}G)^{1}H+14(^{2}H)^{1}H	$3d^44s(b\,^2I)4p$	$v\,^3$I	60428	59965	463		0.916
	6	74+11(A^{2}G)^{3}H			60528	60244	284		1.042
	7	85+6(^{2}I)^{3}I			60656	60433	223		1.142
(^{4}F)^{5}G*	2	50+48(^{4}F)^{5}G				60015			0.338
	3	52+45(^{4}F)^{5}G				60120			0.916
	4	54+41(^{4}F)^{5}G				60259			1.142
	5	44+29(^{4}F)^{5}G				60398			1.219
	6	54+30(^{4}F)^{5}G				60650			1.296
(A^{2}G)^{1}G	4	42+29(^{2}H)^{1}G+15(A^{2}F)^{1}G				60335			1.006
(A^{2}F)^{1}F	3	21+17(A^{2}D)^{1}F+17(A^{2}G)^{3}G				60348			1.010
(^{2}H)^{1}H	5	13+20(A^{2}G)^{3}G+18(^{2}H)^{3}I			60006	60385	−279		1.054
(A^{2}G)^{3}G	3	33+16(A^{2}F)^{1}F+7(^{2}H)^{3}G		$s\,^3$G	60518	60383	135		0.846
	4	40+9(^{2}H)^{3}G+6(^{2}H)^{1}G			60504	60375	129		1.042
	5	30+21(^{2}H)^{3}I+11(^{4}F)^{5}G*			60468	60328	140		1.098
A^{3}P(^{1}P)^{3}S	1	48+19A^{3}P(^{1}P)^{3}P+10(A^{2}F)^{3}D	$3d^44s(a\,^2P)4p$	$x\,^3$S	60084	60406	−322		1.751
(A^{2}D)^{3}D	1	29+22A^{1}D(^{3}P)^{3}D+19(^{4}F)^{3}D	$3d^5(b\,^2F)4p$	$s\,^3$D	60678	60408	270		0.532
	2	25+24A^{1}D(^{3}P)^{3}D+20(^{4}F)^{3}D			60630	60295	335		1.161
	3	17+24(^{4}F)^{3}D+17A^{1}D(^{3}P)^{3}D			60616	60151	465		1.236

TABLE 2. *Observed and calculated levels of* Cr I $(3d+4s)^5 4p$ – Continued

Name	J	Percentage	AEL		Obs. level (cm^{-1})	Calc. level (cm^{-1})	O–C	Obs. g-factor	Calc. g-factor
			Config.	Desig.					
$(A^2G)^3H$	4	$52+13^3H(^1P)^3H+8(^2H)^3H$	$3d^44s(c\,^2G)4p$	$s\,^3H$	60871	60669	202		0.834
	5	$41+11^3H(^1P)^3H+7(^2H)^3H$			61008	60862	146		1.072
	6	$35+27(^2H)^1I+7(^2H)^3H$			61192	61243	−51		1.112
$A^3P(^1P)^3P$	0	$47+17(A^2D)^3P$				60750			
	1	$20+26A^3P(^1P)^3S+10(A^2F)^3D$				61037			1.369
	2	$29+10(A^2F)^3D$				60996			1.288
$(^2H)^3G$	3	$24+19(B^2F)^3G+16(^4F)^3G$	$3d^5(b\,^2G)4p$	$r\,^3G$	61078	60837	241		0.760
	4	$19+15(B^2F)^3G+12(^4F)^3G$			61123	60903	220		1.030
	5	$15+15(A^2G)^3H+12(B^2F)^3G$			61161	60989	173		1.160
$(^2H)^1I$	6	$49+17(A^2G)^3H+10(^2I)^1I$			60441	60911	−470		1.074
$^3D(^3P)^1D$	2	$18+16(B^2F)^3F+12(A^2D)^1D$				61062			0.905
$(B^2F)^3F$	2	$11+11^3D(^3P)^1D+10(B^2F)^3D$				61380			1.079
	3	$40+21^1F(^3P)^3F$	$3d^44s(c\,^2G)4p$	$p\,^3F$	60820	61168	−348		1.087
	4	$39+24^1F(^3P)^3F+10A^1D(^3P)^3F$			60961	61115	−154		1.241
$A^3F(^1P)^3D$	1	$24+22(A^2F)^3D+20A^3P(^1P)^3D$				61297			0.879
	2	$21+11^3D(^3P)^1D+10(B^2F)^3D$				61457			1.104
	3	$31+27(B^2F)^3D+22A^3P(^1P)^3D$				61363			1.327
$(^2H)^1G$	4	$25+26(A^2G)^1G+26A^1G(^1P)^1G$				61499			1.006
$A^1D(^3P)^3P$	0	$77+7(A^2D)^3P$	$3d^44s(a\,^2P)4p$	$t\,^3P$	(61388)	61569	(−181)		
	1	$65+8(A^2D)^3P$			(61527)	61647	(−120)		1.444
	2	$58+8(^4F)^5F^*$			(61676)	61753	(−74)		1.411
$^3G(^1P)^3H$	4	$46+17(^2I)^3H+15(A^2G)^3H$				61823			0.833
	5	$36+18(^4F)^3G+13(^2I)^3H$				61895			1.081
	6	$52+18(A^2G)^3H+16(^2I)^3H$				62048			1.165
$(^4F)^5F^*$	1	$77+16(^4F)^5F$				61886			0.033
	2	$68+14(^4F)^5F$				61967			1.048
	3	$77+15(^4F)^5F$				62159			1.243
	4	$59+10(^4F)^5F$				62272			1.268
	5	$80+12(^4F)^5F$				62618			1.390
$(^4F)^5D^*$	0	$77+12(^4F)^5D$				62075			
	1	$76+12(^4F)^5D$				62123			1.489
	2	$76+10(^4F)^5D$				62225			1.491
	3	$77+8(^4F)^5D$				62386			1.492
	4	$75+6(^4F)^5D$				62599			1.479
$(^4F)^3G$	3	$48+15^3G(^1P)^3G+9(^4F)^3G^*$		$q\,^3G$	61930	62166	−236		0.769
	4	$32+20(^4F)^5F^*+10(B^2F)^3G$			61976	62227	−251		1.115
	5	$31+15^3G(^1P)^3H+11(B^2F)^3G$			62038	62114	−76		1.153
$(^4F)^3F$	2	$23+21(A^2G)^3F+19(^4F)^3F^*$				62702			0.675
	3	$19+18(A^2G)^3F+18(^4F)^3F^*$				62700			1.067
	4	$18+20(A^2G)^3F+18(^4F)^3F^*$				62779			1.251

TABLE 2. *Observed and calculated levels of* Cr I $(3d+4s)^5 4p$—Continued

Name	J	Percentage	AEL	Obs. level (cm^{-1})	Calc. level (cm^{-1})	O–C	Obs. g-factor	Calc. g-factor
$(A^2G)^1F$	3	$64+10A^1D(^1P)^1F$			62780			1.007
$(A^2G)^1H$	5	$50+32(^2H)^1H$			62992			1.008
$(B^2F)^3D$	1	$44+25(^4F)^3D^*+10^3D(^1P)^3D$			63218			0.505
	2	$44+24(^4F)^3D^*+8^3D(^1P)^3D$			63337			1.166
	3	$40+22(^4F)^3D^*+9^3D(^1P)^3D$			63498			1.254
$(B^2F)^1G$	4	$58+5(^2H)^3H$			63294			0.988
$(B^2F)^1D$	2	$73+13^3D(^3P)^1D$			63373			1.002
$^3H(^1P)^3G$	3	$17+23(A^2G)^3G+14(B^2F)^3G$			63493			0.843
	4	$20+21(B^2F)^1G+14(A^2G)^3G$			63444			0.986
	5	$19+17(A^2G)^3G+17(^2H)^3H$			63508			1.132
$(^2H)^3H$	4	$30+15(A^2G)^3G+13^3H(^1P)^3H$			63768			0.897
	5	$27+16(A^2G)^3G+12^3H(^1P)^3H$			63862			1.101
	6	$43+23^3G(^1P)^3H$			63784			1.165
$(B^2F)^1F$	3	$54+30A^1G(^1P)^1F$			63964			1.001
$^1F(^3P)^3F$	2	$18+17^3G(^1P)^3F+16(^4F)^3F$			64245			0.674
	3	$18+16(^4F)^3F+15^3G(^1P)^3F$			64263			1.077
	4	$19+16(^4F)^3F+16^3G(^1P)^3F$			64254			1.240
$A^1D(^1P)^1P$	1	$24+25(^2S)^1P+15A^1S(^1P)^1P$			64549			1.067
$^1F(^3P)^3G$	3	$76+14(^2H)^3G$			64795			0.756
	4	$77+13(^2H)^3G$			64887			1.053
	5	$77+13(^2H)^3G$			64997			1.199
$^3D(^1P)^3P$	0	$51+19(^2S)^3P+19(^4P)^3P^*$			65007			
	1	$44+17(^2S)^3P+15(^4P)^3P^*$			65038			1.427
	2	$53+19(^4P)^3P^*+15(^2S)^3P$			64984			1.494
$(A^2G)^3F$	2	$22+18(B^2F)^3F+15^3D(^1P)^3F$			65192			0.669
	3	$26+20(B^2F)^3F+15^3D(^1P)^3F$			65200			1.067
	4	$27+25(B^2F)^3F+19^3D(^1P)^3F$			65227			1.245
$^3D(^1P)^3D$	1	$42+12(^4F)^3D$			65466			0.506
	2	$42+11^1F(^3P)^3D$			65454			1.165
	3	$40+17^1F(^3P)^3D$			65424			1.329
$(B^2F)^3G$	3	$44+17(^2H)^3G+10^3H(^1P)^3G$			65446			0.769
	4	$46+17(^2H)^3G+11^3H(^1P)^3G$			65538			1.054
	5	$47+15(^2H)^3G+8^1F(^3P)^3G$			65637			1.197
$^3G(^1P)^3F$	2	$18+24(B^2F)^3F+19^1F(^3P)^3F$			66000			0.718
	3	$17+22(B^2F)^3F+17^1F(^3P)^3F$			66115			1.128
	4	$20+26(B^2F)^3F+19^1F(^3P)^3F$			66174			1.250
$^1F(^3P)^3D$	1	$74+8^3D(^1P)^3D$			66219			0.502
	2	$62+9^3D(^1P)^3D$			66138			1.123
	3	$54+9^3D(^1P)^3D$			65979			1.291

TABLE 2. *Observed and calculated levels of* Cr I, $(3d+4s)^5 4p$ – Continued

Name	J	Percentage	AEL	Obs. level (cm^{-1})	Calc. level (cm^{-1})	O–C	Obs. g-factor	Calc. g-factor
$^1I(^1P)^1H$	5	$27+37A^1G(^1P)^1H$			66527			1.005
$^1I(^1P)^1K$	7	98			67188			1.000
$^1I(^1P)^1I$	6	$77+9(^2H)^1I$			67255			1.001
$A^3P(^1P)^3D$	1	$33+34(B^2F)^3D+12(B^2D)^3D$			67309			0.513
	2	$32+30(B^2F)^3D+11(B^2D)^3D$			67409			1.142
	3	$29+20(B^2F)^3D+10(B^2D)^3D$			67568			1.345
$B^3P(^3P)^5P$	1	91			67556			2.417
	2	$85+6B^3P(^3P)^5S$			67413			1.824
	3	$75+7(B^2F)^3D$			67436			1.593
$B^3F(^3P)^5F$	1	91			67572			0.065
	2	88			67596			0.995
	3	$79+3(^4F)^3F^*$			67619			1.232
	4	$64+10A^1G(^1P)^1G$			67674			1.260
	5	94			67623			1.399
$^3G(^1P)^3G$	3	$23+25(^4F)^3G^*+9(A^2G)^3G$			67574			0.767
	4	$21+24(^4F)^3G^*+10(A^2G)^3G$			67738			1.060
	5	$19+25(^4F)^3G^*+9(A^2G)^3G$			67944			1.162
$A^1G(^1P)^1G$	4	$18+19B^3F(^3P)^5F+13(^2G)^1G^*$			67769			1.108
$^3D(^1P)^3F$	2	$35+20(^4F)^3F^*+10^3G(^1P)^3F$			67698			0.713
	3	$26+14(^4F)^3F^*+12^3G(^1P)^3F$			67834			1.136
	4	$31+25(^4F)^3F^*+10^3G(^1P)^3F$			67969			1.232
$(^2S)^3P$	0	$59+11(^4P)^3P^*+10(B^2D)^3P$			67778			
	1	$59+10(^4P)^3P^*+10(B^2D)^3P$			67851			1.482
	2	$59+12(B^2D)^3P+10(^4P)^3P^*$			67967			1.492
$B^3P(^3P)^5D$	0	$73+18B^3F(^3P)^5D$			68152			
	1	$60+19B^3F(^3P)^5D$			68138			1.522
	2	$68+17B^3F(^3P)^5D$			68087			1.513
	3	$67+17B^3F(^3P)^5D$			68015			1.503
	4	$71+15B^3F(^3P)^5D$			67870			1.487
$A^1G(^1P)^1H$	5	$35+14^1I(^1P)^1H+13(^2G)^1H^*$			68150			1.038
$(^2S)^1P$	1	$51+29(B^2D)^1P$			68406			0.998
$B^3F(^3P)^5G$	2	98			68572			0.336
	3	98			68608			0.917
	4	98			68649			1.150
	5	98			68687			1.266
	6	99			68714			1.333
$A^1G(^1P)^1F$	3	$23+21(B^2D)^1F+14(^2G)^1F^*$			68695			1.000
$B^3P(^3P)^5S$	2	$78+13(^4P)^5S^*$			68777			1.980
$A^1D(^1P)^1F$	3	$27+28(B^2F)^1F+19A^1G(^1P)^1F$			69433			1.001

TABLE 2. *Observed and calculated levels of* Cr I $(3d+4s)^5 4p$ – Continued

Name	J	Percentage	AEL	Obs. level (cm^{-1})	Calc. level (cm^{-1})	O–C	Obs. g-factor	Calc. g-factor
$A^1D(^1P)^1D$	2	$53+20(B^2D)^1D$			69795			1.014
$B^3F(^3P)^5D$	0	$52+40(^4P)^5D^*$			69957			
	1	$53+39(^4P)^5D^*$			69969			1.498
	2	$56+37(^4P)^5D^*$			69987			1.498
	3	$56+34(^4P)^5D^*$			69994			1.498
	4	$61+30(^4P)^5D^*$			69970			1.499
$A^1S(^1P)^1P$	1	$33+25A^1D(^1P)^1P+8(^2P)^1P^*$			70048			0.896
$B^3P(^3P)^3D$	1	$43+19B^3F(^3P)^3D$			70229			0.615
	2	$45+18B^3F(^3P)^3D$			70103			1.169
	3	$52+16B^3F(^3P)^3D$			70087			1.336
$(^4P)^3P^*$	0	$28+37(B^2D)^3P+19B^3P(^3P)^3P$			70539			
	1	$28+36(B^2D)^3P+18B^3P(^3P)^3P$			70518			1.493
	2	$29+32(B^2D)^3P+18B^3P(^3P)^3P$			70445			1.480
$B^3F(^3P)^3F$	2	$69+16(B^2D)^3F$			70623			0.670
	3	$70+16(B^2D)^3F$			70642			1.084
	4	$72+16(B^2D)^3F$			70689			1.251
$B^3P(^3P)^1D$	2	$44+27(B^2D)^1D$			71354			0.997
$(^4P)^5P^*$	1	95			71377			2.493
	2	95			71506			1.831
	3	95			71665			1.665
$(B^2D)^3F$	2	$60+20B^3F(^3P)^3F$			71953			0.673
	3	$61+21B^3F(^3P)^3F$			72025			1.081
	4	$62+20B^3F(^3P)^3F$			72139			1.247
$B^3P(^3P)^3P$	0	$48+17(^4P)^3P^*$			72448			
	1	$49+18(^4P)^3P^*$			72438			1.501
	2	$43+13(^4P)^3P^*$			72329			1.354
$(^2G)^3H^*$	4	$66+10(B^2G)^3H$			72474			0.808
	5	$52+18B^3F(^3P)^3G+10(B^2G)^3H$			72617			1.068
	6	$65+12(B^2G)^3H$			72942			1.166
$(B^2D)^1F$	3	$39+14(^2G)^1F^*+10^1F(^1P)^1F$			72577			0.961
$(B^2D)^1D$	2	$16+15A^1D(^1P)^1D+10^1F(^1P)^1D$			72610			1.146
$B^3F(^3P)^3G$	3	$72+8(B^2D)^1F$			72607			0.793
	4	84			72572			1.045
	5	$69+15(^2G)^3H^*$			72624			1.165
$(B^2D)^3D$	1	$61+12(^4P)^3D^*$			72899			0.527
	2	$60+11(^4P)^3D^*$			72970			1.179
	3	$62+8(^4P)^3D^*$			73071			1.335
$B^3P(^3P)^3S$	1	75			73216			1.930
$B^3F(^3P)^1F$	3	$79+10(B^2G)^1F$			73515			1.001
$B^3F(^3P)^1G$	4	$50+28^1F(^1P)^1G+12(^2H)^1G^*$			73686			1.000

TABLE 2. *Observed and calculated levels of* Cr I $(3d+4s)^5 4p$ – Continued

Name	J	Percentage	AEL	Obs. level (cm^{-1})	Calc. level (cm^{-1})	O–C	Obs. g-factor	Calc. g-factor
$^4P(^5D)$*	0	$49+24B^3F(^3P)^5D$			73609			
	1	$50+23B^3F(^3P)^5D$			73644			1.507
	2	$52+21B^3F(^3P)^5D$			73701			1.487
	3	$58+20B^3F(^3P)^5D$			73799			1.494
	4	$65+20B^3F(^3P)^5D$			73918			1.500
$(B^2D)^3P$	0	$32+31B^3P(^3P)^3P$			73702			
	1	$32+29B^3P(^3P)^3P$			73675			1.513
	2	$35+30B^3P(^3P)^3P$			73603			1.494
$(^2P)^1S$*	0	$64+21B^3P(^3P)^1S$			74127			
$(^4P)^3D$*	1	$52+22B^3F(^3P)^3D$			74478			0.509
	2	$40+16B^3F(^3P)^3D+12(^2P)^1D$*			74399			1.125
	3	$57+29B^3F(^3P)^3D$			74601			1.330
$B^3P(^3P)^1P$	1	$47+26(B^2D)^1P$			74565			1.013
$(^2P)^1D$*	2	$30+22^1F(^1P)^1D+14(^4P)^3D$*			74875			1.044
$(^2G)^3G$*	3	$52+18(B^2G)^3G+8^3H(^1P)^3G$			75101			0.755
	4	$51+20(B^2G)^3G+9^3H(^1P)^3G$			75235			1.049
	5	$27+21(^2G)^1H$*$+18(^2H)^1H$*			75350			1.099
$(^2G)^1H$*	5	$18+18(B^2G)^3G+15(^2H)^1H$*			75487			1.118
$B^1G(^3P)^3G$	3	$73+18(B^2G)^3G$			75376			0.754
	4	$73+17(B^2G)^3G$			75421			1.049
	5	$60+18(^2G)^3G$*$+13(B^2G)^3G$			75544			1.180
$^1F(^1P)^1F$	3	$45+25(B^2G)^1F+15(B^2D)^1F$			75509			0.998
$B^3F(^3P)^3D$	1	$45+18B^3P(^3P)^3D$			76101			0.766
	2	$51+30B^3P(^3P)^3D$			76052			1.108
	3	$50+27B^3P(^3P)^3D$			75987			1.297
$(B^2D)^1P$	1	$29+33B^3P(^3P)^1P+12(^2P)^1P$*			76187			1.002
$B^3P(^3P)^1S$	0	$67+27(^2P)^1S$*			76228			
$(^4P)^3S$*	1	$38+23B^3P(^3P)^3S+18(^2P)^3S$*			76239			1.729
$(^2G)^3F$*	2	$28+31B^1G(^3P)^3F+16(B^2G)^3F$			76311			0.723
	3	$24+30B^1G(^3P)^3F+17(B^2G)^3F$			76286			1.115
	4	$13+14B^1G(^3P)^3F+13(B^2G)^3F$			76190			1.129
$^1F(^1P)^1G$	4	$10+13B^1G(^3P)^3F+12(^2G)^3F$*			76307			1.109
$B^1G(^3P)^3H$	4	$72+21(B^2G)^3H$			76419			0.814
	5	$75+22(B^2G)^3H$			76490			1.035
	6	$75+23(B^2G)^3H$			76590			1.167
$(^4P)^5S$*	2	$83+14B^3P(^3P)^5S$			76937			1.990
$(^2G)^1G$*	4	$24+25B^3F(^3P)^1G+19^1F(^1P)^1G$			77098			0.987
$B^1G(^3P)^3F$	2	$35+31(A^2D)^3F$*			77452			0.724
	3	$27+20^1F(^1P)^1F+12(^2G)^1F$*			77500			1.045
	4	$22+14^1F(^1P)^1G+12(^2G)^3F$*			77640			1.235
$(^2G)^1F$*	3	$12+16B^1G(^3P)^3F+17(B^2G)^1F$			77598			1.055

TABLE 2. *Observed and calculated levels of* Cr I $(3d+4s)^5 4p$ – Continued

Name	J	Percentage	AEL	Obs. level (cm^{-1})	Calc. level (cm^{-1})	O–C	Obs. g-factor	Calc. g-factor
$(^2P)^3P^*$	0	$47+28(A^2D)^3P^*$			77529			
	1	$45+27(A^2D)^3P^*$			77700			1.506
	2	$30+25(^2P)^3D^*+9(A^2D)^3P^*$			78191			1.340
$(B^2G)^3H$	4	$60+13(^2H)^3H^*+9(^2G)^3H^*$			77673			0.830
	5	$65+16(^2H)^3H^*+11(^2G)^3H^*$			77745			1.033
	6	$67+15(^2H)^3H^*+12(^2G)^3H^*$			77894			1.166
$(^2P)^3D^*$	1	$72+15B^3F(^3P)^3D$			77981			0.510
	2	$41+12(^2P)^3P^*$			78101			1.149
	3	$45+20(B^2G)^3F+9(^2G)^3F^*$			78380			1.228
$(B^2G)^3F$	2	$42+19B^3F(^1P)^3F+10B^1G(^3P)^3F$			78202			0.830
	3	$39+27(^2P)^3D^*+21B^3F(^1P)^3F$			78203			1.168
	4	$56+24B^3F(^1P)^3F+12(^2G)^3F^*$			78162			1.248
$(A^2D)^1D^*$	2	$21+16(B^2G)^3F+9(^2P)^1D^*$			78383			1.011
$B^3F(^3P)^1D$	2	$61+20B^3P(^3P)^1D$			78680			1.030
$(B^2G)^1H$	5	$75+8(^2H)^3I^*$			78822			0.988
$(^2P)^3S^*$	1	$53+24(^4P)^3S^*+13B^3P(^3P)^3S$			78892			1.948
$(^2H)^3H^*$	4	$53+15(B^2G)^3H+12(^2G)^3H^*$			79032			0.847
	5	$42+15(B^2G)^3G+10(^2H)^3I^*$			79162			1.055
	6	$61+16(^2H)^3I^*+10(^2G)^3H^*$			79376			1.142
$(B^2G)^3G$	3	$42+27B^3F(^1P)^3G+15(^2G)^3G^*$			79101			0.753
	4	$40+19B^3F(^1P)^3G+15(^2G)^3G^*$			79202			1.028
	5	$30+25(^2H)^3H^*+12(^2G)^3G^*$			79371			1.116
$(A^2D)^3P^*$	0	$31+20(^2P)^3P^*+19B^3P(^1P)^3P$			79193			
	1	$32+15(^2P)^3P^*+15B^3P(^1P)^3P$			79112			1.530
	2	$34+21B^3P(^1P)^3P+16(^2P)^3P^*$			79027			1.422
$(^2H)^3I^*$	5	$72+8(B^2G)^3G+7(B^2G)^1H$			79422			0.912
	6	$81+9(^2H)^3H^*$			79640			1.048
	7	98			79625			1.143
$(B^2G)^1G$	4	$48+35(^2G)^1G^*+9(^2H)^3H^*$			79768			0.980
$(B^2G)^1F$	3	$37+14(^2G)^1F^*+11(^2H)^3G^*$			79904			0.932
$(^2H)^3G^*$	3	$28+26(B^2G)^3G+15(B^2G)^1F$			80175			0.828
	4	$40+29(B^2G)^3G+16B^3F(^1P)^3G$			80205			1.054
	5	$40+31(B^2G)^3G+16B^3F(^1P)^3G$			80256			1.199
$(A^2D)^3F^*$	2	$43+28(^2G)^3F^*$			80717			0.673
	3	$42+27(^2G)^3F^*$			80821			1.078
	4	$45+26(^2G)^3F^*$			80914			1.243
$B^3P(^1P)^3D$	1	77			82133			0.510
	2	73			81980			1.168
	3	80			81698			1.332
$(A^2D)^3D^*$	1	$75+8^3D(^1P)^3D$			81944			0.547
	2	$76+7^3D(^1P)^2D$			82108			1.168
	3	$50+16(A^2D)^1F^*$			82304			1.209

TABLE 2. *Observed and calculated levels of* Cr I $(3d+4s)^5 4p$ – Continued

Name	J	Percentage	AEL	Obs. level (cm^{-1})	Calc. level (cm^{-1})	O–C	Obs. g-factor	Calc. g-factor
$(A^2D)^1F^*$	3	$37+30(A^2D)^3D^*$			81992			1.126
$(^2H)^1H^*$	5	$42+29(^2G)^1H^*+20^1I(^1P)^1H$			82237			1.000
$(^2H)^1I^*$	6	92			82252			1.001
$(A^2D)^1P^*$	1	$68+14A^1S(^1P)^1P$			82773			0.978
$(^2H)^1G^*$	4	$54+26^1F(^1P)^1G+14B^1G(^1P)^1G$			82801			1.006
$B^3F(^1P)^3F$	2	$73+16(B^2G)^3F$			83311			0.670
	3	$71+17(B^2G)^3F$			83365			1.084
	4	$70+18(B^2G)^3F$			83409			1.245
$(^2P)^1P^*$	1	$52+27A^1D(^1P)^1P+8(^2P)^1P$			83595			0.983
$B^3F(^1P)^3D$	1	$53+12(^4P)^3D^*$			85283			0.717
	2	$49+11(^4P)^3D^*$			85200			1.253
	3	$70+16(B^2G)^3F$			85224			1.331
$B^3P(^1P)^3P$	0	$30+25(B^2D)^3P^*+23(^2P)^3P$			85523			
	1	$31+22(B^2D)^3P^*+16(^2P)^3P$			85516			1.285
	2	$33+21(B^2D)^3P^*+14(^2P)^3P$			85452			1.408
$B^3F(^1P)^3G$	3	$52+32(^2H)^3G^*$			86638			0.755
	4	$53+32(^2H)^3G^*$			86653			1.050
	5	$55+33(^2H)^3G^*$			86647			1.199
$B^1G(^1P)^1F$	3	$40+26(^2F)^1F^*+15(A^2D)^1F^*$			87247			0.998
$^1F(^1P)^1D$	2	$25+29(A^2D)^1D^*+23(^2P)^1D^*$			87510			1.013
$(^2P)^3P$	0	$48+20(C^2D)^3P+15B^3P(^1P)^3P$			87486			
	1	$48+19(C^2D)^3P+13B^3P(^1P)^3P$			87496			1.531
	2	$48+17(C^2D)^3P+13B^1D(^3P)^3P$			87654			1.479
$B^1G(^1P)^1G$	4	$45+40(^2F)^1G^*$			88071			1.001
$(^2P)^1D$	2	$41+28(^2P)^3D+16(C^2D)^1D$			88166			1.067
$B^3P(^1P)^3S$	1	$43+21(^4P)^3S^*$			88353			1.963
$(^2P)^3D$	1	$79+8(C^2D)^3D$			88338			0.503
	2	$51+24(^2P)^1D$			88483			1.111
	3	$80+10(C^2D)^3D$			88440			1.332
$(^2P)^1S$	0	$79+10B^3P(^3P)^1S$			88482			
$B^1D(^3P)^3P$	0	$69+20(B^2D)^3P$			88763			
	1	$73+21(B^2D)^3P$			88667			1.502
	2	$69+22(B^2D)^3P$			88583			1.498
$(^2F)^3F^*$	2	$52+35B^1D(^3P)^3F$			89512			0.671
	3	$53+35B^1D(^3P)^3F$			89548			1.083
	4	$54+33B^1D(^3P)^3F$			89599			1.249
$(^2P)^1P$	1	$78+6(^2P)^1P^*$			89665			1.033

TABLE 2. *Observed and calculated levels of* Cr I $(3d+4s)^5 4p$ – Continued

Name	J	Percentage	AEL	Obs. level (cm^{-1})	Calc. level (cm^{-1})	O – C	Obs. *g*-factor	Calc *g*-factor
$B^1G(^1P)^1H$	5	$84+10(^2H)^1H^*$			89871			1.001
$(^2P)^3S$	1	$79+16B^3P(^1P)^3S$			90104			1.960
$B^1D(^3P)^3F$	2	$48+39(^2F)^3F^*$			91733			0.671
	3	$39+38(^2F)^3G^*+20(^2F)^3F^*$			91804			0.942
	4	$38+40(^2F)^3G^*+23(^2F)^3F^*$			92008			1.160
$(^2F)^3G^*$	3	$51+20B^1D(^3P)^3F+18(^2F)^3F^*$			91975			0.894
	4	$49+27B^1D(^3P)^3F+15(^2F)^3F^*$			91870			1.140
	5	$89+7(^2H)^3G^*$			92072			1.200
$(C^2D)^1D$	2	$51+20(^2F)^1D^*+12(^2P)^1D^*$			92513			1.015
$B^1D(^3P)^3D$	1	$65+17(^2F)^3D^*$			92563			0.501
	2	$56+16(^2F)^3D^*$			92585			1.132
	3	$66+20(^2F)^3D^*$			92597			1.325
$(C^2D)^3F$	2	$77+14B^1D(^3P)^3F$			92876			0.688
	3	$76+15B^1D(^3P)^3F$			92947			1.090
	4	$82+15B^1D(^3P)^3F$			93056			1.250
$(^2F)^1D^*$	2	$55+16(C^2D)^1D+11(^2P)^1D$			93606			0.998
$(C^2D)^1F$	3	$56+34(^2F)^1F^*$			93669			1.002
$(C^2D)^3D$	1	$61+25B^1D(^3P)^3D$			94122			0.503
	2	$60+27B^1D(^3P)^3D$			94171			1.166
	3	$54+30B^1D(^3P)^3D$			94223			1.332
$(C^2D)^1P$	1	$83+15B^1D(^1P)^1P$			94282			0.999
$(C^2D)^3P$	0	$65+17(^2P)^3P$			95463			
	1	$69+16(^2P)^3P$			95376			1.474
	2	$65+16(^2P)^3P$			95205			1.492
$(^2F)^3D^*$	1	$52+17(C^2D)^3D$			95687			0.527
	2	$50+15(C^2D)^3D+12B^3F(^1P)^3D$			95602			1.173
	3	$45+20(C^2D)^3D+11B^3F(^1P)^3D$			95481			1.332
$(^2F)^1G^*$	4	$53+33B^1G(^1P)^1G$			95731			1.000
$(^2F)^1F^*$	3	$23+24B^1G(^1P)^1F+22(C^2D)^1F$			97065			1.001
$B^1D(^1P)^1D$	2	$45+45(B^2D)^1D^*$			102494			1.000
$B^1D(^1P)^1P$	1	$76+8(^2P)^1P$			103232			1.000
$B^1D(^1P)^1F$	3	$82+8(^2F)^1F^*$			104434			1.000
$(B^2D)^3D^*$	1	91			108022			0.505
	2	90			108022			1.169
	3	92			108043			1.333
$B^1S(^3P)^3P$	0	$84+12(B^2D)^3P^*$			108492			
	1	$83+15(B^2D)^3P^*$			108554			1.496
	2	$80+18(B^2D)^3P^*$			108672			1.498

TABLE 2. *Observed and calculated levels of* Cr I $(3d+4s)^5 4p$ – Continued

Name	J	Percentage	AEL	Obs. level (cm^{-1})	Calc. level (cm^{-1})	O – C	Obs. g-factor	Calc. g-factor
$(B^2D)^3F^*$	2	94			109706			0.667
	3	94			109704			1.083
	4	95			109733			1.250
$(B^2D)^1F^*$	3	91			111383			1.001
$(B^2D)^1P^*$	1	$40+31(B^2D)^3P^*+18B^1S(^1P)^1P$			112076			1.216
$(B^2D)^3P^*$	0	$83+14B^1S(^3P)^3P$			112286			
	1	$52+30(B^2D)^1P^*+12B^1S(^3P)^3P$			112181			1.283
	2	$78+18B^1S(^3P)^3P$			112084			1.499
$(B^2D)^1D^*$	2	$48+40B^1D(^1P)^1D$			112825			1.001
$B^1S(^1P)^1P$	1	$74+23(B^2D)^1P^*$			124551			1.000

TABLE 3. *Orders of the submatrices for* $(d+s)^5p$

J	Order
0	39
1	107
2	144
3	145
4	117
5	76
6	39
7	14
8	3

The approximate time for the diagonalization routine on the IBM 7040 computer was 4 1/2 hr.

The work described in this paper was supported in part by the National Bureau of Standards, Washington, D. C.

4. References

[1] Roth, C., Nat. Bur. Stand. (U.S.), **72A** (Phys. and Chem.) No. 5, 505–520 (Sept – Oct. 1968).
[2] Roth, C., Nat. Bur. Stand. (U.S.), **73A** (Phys. and Chem.) No. 2, 125–157 (Mar.–Apr. 1969).
[3] Roth, C., Nat. Bur. Stand. (U.S.), **73A** (Phys. and Chem.) No. 2, 159–171 (Mar.–Apr. 1969).
[4] Roth, C., Nat. Bur. Stand. (U.S.), **73A** (Phys. and Chem.) No. 6, 509–609 (Nov.–Dec. 1969).
[5] Rohrlich, F., Phys. Rev. **74,** 1381 (1948).
[6] Roth, C., Nat. Bur. Stand. (U.S.), **73A** (Phys. and Chem.) No. 5, 497–510 (Sept.–Oct. 1969).
[7] Roth, C., Nat. Bur. Stand. (U.S.), **74A** (Phys. and Chem.), No. 2, (Mar.–Apr. 1970).
[8] Moore, C. E., Atomic Energy Levels, Nat. Bur. Stand. (U.S.), Circ. 467, Vol. II (1952), referred to as AEL.
[9] Roth, C., J. Math. Phys. **9,** No. 4, 686 (1968).
[10] Kiess, C. C., J. Res. NBS **51,** No. 5,247, (1953) RP2457.
[11] Racah, G., J. Quant. Spectrosc. Radiat. Transfer **4,** 617 (1964).

(Paper 74A2–589)